THE

POPULAR SCIENCE MONTHLY.

JUNE, 1889.

NEW CHAPTERS IN THE WARFARE OF SCIENCE.

VI.—DIABOLISM AND HYSTERIA.

By ANDREW DICKSON WHITE, LL. D., L. H. D.,
EX-PRESIDENT OF CORNELL UNIVERSITY.

PART II.

ABOUT forty years later than the New England epidemic of "possession" occurred another typical series of phenomena in France. In the year 1727 there died in the city of Paris a simple and kindly ecclesiastic, the Archdeacon of Paris. He had lived a pious, Christian life, and was endeared to multitudes by his charity; unfortunately, he had espoused the doctrine of Jansen on the subject of grace and free will; and, though he remained in the Gallican Church, he and those who thought like him were opposed by the Jesuits, and finally condemned by a papal bull.

His remains having been buried in the cemetery of St. Medard, the Jansenists flocked to say their prayers at his tomb, and soon miracles began to be wrought there. Ere long they were multiplied. The sick being brought and laid upon the tomb, many were cured. Wonderful stories were attested by eye-witnesses. The myth-making tendency—the passion for developing, enlarging, and spreading tales of wonder—came into full play and was given free course.

Many thoughtful men satisfied themselves of the truth of these representations. One of the foremost English scholars came over, examined into them, and declared that there could be no doubt as to the reality of the cures.

This state of things continued for about four years, when, in 1731, more violent effects showed themselves. Sundry persons approaching the tomb were thrown into convulsions, hysterics, and catalepsy; these diseases spread, became epidemic, and soon

multitudes were similarly afflicted. Both religious parties made the most of these cases. In vain did such great authorities in medical science as Hecquet and Lorry attribute the whole to natural causes; the theologians on both sides declared them supernatural —the Jansenists attributing them to God, the Jesuits to Satan.

Of late years such cases have been treated in France with much shrewdness. When, about the middle of the present century, the Arab priests in Algiers tried to arouse fanaticism against the French Christians by performing miracles, the French Government, instead of persecuting the priests, sent Robert Houdin, the most renowned juggler of his time, to Algiers, and for every Arab miracle Houdin performed two; did an Arab marabout turn a rod into a serpent, Houdin turned his rod into two serpents, and afterward showed the people how this was done.

So, too, at the last International Exposition, the French Government, observing the evil effects produced by the mania for table turning and tipping, took occasion, when a great number of French schoolmasters and teachers were visiting the Exposition, to have public lectures given in which all the business of dark closets, hand-tying, materialization of spirits, presenting the faces of the departed, and ghostly portraiture, was fully performed by professional mountebanks, and afterward as fully explained by them.

So in this case. The Government simply ordered the gate of the cemetery to be locked, and, when the crowd could no longer approach the tomb, the miracles ceased. A little Parisian ridicule helped to end the matter. A wag wrote up over the gate of the cemetery:

"De par le Roi, défense à Dieu
De faire des miracles dans ce lieu"—

which, being translated from doggerel French into doggerel English, is—

"By order of the king, the Lord must forbear
To work any more of his miracles here."

But the theological spirit remained powerful. The French Revolution had not then intervened to bring it under healthy limits. The agitation was maintained, and, though the miracles and cases of possession were stopped in the cemetery, it spread. Again full course was given to myth-making and the retailing of wonders. It was said that men had allowed themselves to be roasted before slow fires, and had been afterward found uninjured; that some had enormous weights piled upon them, but had supernatural powers of resistance given them; and that, in one case, a voluntary crucifixion had taken place.

This agitation was long, troublesome, and no doubt robbed

many temporarily or permanently of such little brains as they possessed; it was only when the violence had become an old story and the charm of novelty had entirely worn off, and the afflicted found themselves no longer regarded with especial interest, that the epidemic died away.*

But in Germany at that time the outcome of this belief was far more cruel. In 1749 Maria Renata Sänger, sub-prioress of a convent at Würzburg, was charged with bewitching her fellow-nuns. There was the usual story—the same essential facts as at Loudun—women shut up against their will, dreams of Satan disguised as a young man, petty jealousies, spites, quarrels, mysterious uproar, trickery, utensils thrown about in a way not to be accounted for, hysterical shrieking and convulsions, and, finally, the torture, confession, and execution of the supposed culprit.†

Various epidemics of this sort broke out from time to time in other parts of the world, though happily, as modern skepticism prevailed, with less cruel results.

In 1760 some congregations of Calvinistic Methodists in Wales became so fervent that they began leaping for joy. The mania spread and gave rise to a sect called the "Jumpers." A similar outbreak took place afterward in England, and has been repeated at various times and places since in our own country.‡

In 1780 came another outbreak in France; but this time it was not the Jansenists who were affected, but the strictly orthodox. A large number of young girls between twelve and nineteen years of age, having been brought together at the church of St. Roch, in Paris, with preaching and ceremonies calculated to arouse hysterics, one of them fell into convulsions. Immediately other children were similarly taken, until some fifty or sixty were engaged in the same antics. This mania spread to other churches and gatherings, proved very troublesome, and in some cases led to results especially painful.

About the same period came a similar outbreak among the Protestants of the Shetland Isles. A woman having been seized with convulsions at church, the disease spread to others, mainly women, who fell into the usual contortions and wild shriekings. A very effective cure proved to be a threat to plunge the diseased into a neighboring pond.

But, as we near the end of the eighteenth century, a fact very

* See Madden, "Phantasmata," chap. xiv; also Sir James Stephen, "History of France," lecture xxvi; also Henry Martin, "Histoire de France," chap. xv, pp. 168 *et seq.*; also Calmeil, liv. v, chap. xxiv; also Hecker's "Essay," iv, 5; and, for samples of myth-making, see the apocryphal "Souvenirs de Créquy."

† See Soldan, Scherr, Diefenbach, and others.

‡ See Adams's "Dictionary of All Religions," article on "Jumpers"; also Hecker's "Essay," iv, 6.

important for science is established. It was found that these manifestations do not arise entirely from religious sources. In 1787 came the noted case at Hodden Bridge, in Lancashire. A girl working in a cotton-manufactory there put a mouse into the bosom of another girl, who had a great dread of mice. The girl thus treated immediately went into convulsions, which lasted twenty-four hours. Shortly afterward three other girls were seized with like convulsions, a little later six more, and finally, in all, twenty-four were attacked. Then came a fact throwing a flood of light upon earlier occurrences. This epidemic, being noised abroad, soon spread to another factory five miles distant. The patients suffered from strangulation, danced, tore their hair, and dashed their heads against the walls. There was a strong belief that it was a disease introduced in cotton, but a resident physician amused the patients with electric shocks, and the disease died out.

In 1801 came a case of similar import in the Charité Hospital at Berlin. A girl fell into strong convulsions. The disease proved contagious, several others becoming afflicted in a similar way; but nearly all were finally cured, principally by the administration of opium, which appears at that time to have been a fashionable remedy.

Similar to this was a case at Lyons in 1851. Sixty women were working together in a shop, when one of them, after a bitter quarrel with her husband, fell into a violent nervous attack. The other women, sympathizing with her, gathered about to assist her, but one after another fell into a similar condition, until twenty were thus prostrated, and a more general spread of the epidemic was only prevented by clearing the premises.*

But, while these cases appeared to the eye of Science fatal to the old conception of diabolic influence, the great majority of such epidemics, when unexplained, continued to give strength to the older view.

In Roman Catholic countries these manifestations, as we have seen, have generally appeared in convents, or in churches where young girls are brought together for their first communion, or at shrines where miracles are supposed to be wrought.

In Protestant countries they appear in times of great religious excitement, and especially when large bodies of young women are submitted to the influence of noisy and frothy preachers. Well-known examples of this in America are seen in the "Jumpers," "Jerkers," and various revival extravagances, especially among the negroes and "poor whites" of the Southern States.

* For these examples and others, see Tuke, "Influence of the Mind upon the Body," vol. i, pp. 100, 277; also Hecker's "Essay," chap. iv.

The proper conditions being given for the development of the disease—generally a congregation composed mainly of young women—any fanatic or overzealous priest or preacher may stimulate hysterical seizures, which are very likely to become epidemic.

As a recent typical example on a large scale, I take the case of diabolic possession at Morzines, a French village on the borders of Switzerland; and it is especially instructive, because it was thoroughly investigated by a competent man of science.

About the year 1853 a sick girl at Morzines, acting strangely, was thought to be possessed of the devil, and was taken to Besançon, where she seems to have fallen into the hands of kindly and sensible ecclesiastics, and, under the operation of the relics preserved in the cathedral there—especially the handkerchief of Christ—the devil was cast out and she was cured. Naturally, much was said of the affair among the peasantry, and soon other cases began to show themselves. The priest at Morzines attempted to quiet the matter by avowing his disbelief in such cases of possession; but immediately a great outcry was raised against him, especially by the possessed themselves. The matter was now widely discussed, and the malady spread rapidly; myth-making and wonder-mongering began; amazing accounts were thus developed and sent out to the world. The afflicted were said to have climbed trees like squirrels; to have shown superhuman strength; to have exercised the gift of tongues, speaking in German, Latin, and even in Arabic; to have given accounts of historical events they had never heard of; and to have revealed the secret thoughts of persons about them. Mingled with such exhibitions of power were outbursts of blasphemy and obscenity.

But suddenly came something more miraculous, apparently, than all these wonders. Without any assigned cause this epidemic of possession diminished, and the devil disappeared.

Not long after this Prof. Tissot, an eminent member of the medical faculty at Dijon, visited the spot and began a series of researches, of which he afterward published a full account. He tells us that he found some reasons for the sudden departure of Satan which had never been published. He discovered that the Government had quietly removed one or two overzealous ecclesiastics to another parish, had sent the police to Morzines to maintain order, and had given instructions that those who acted outrageously should be simply treated as lunatics and sent to asylums. This policy, so accordant with French methods of administration, cast out the devil: the possessed were mainly cured, and the matter appeared ended.

But Dr. Tissot found a few of the diseased still remaining, and he soon satisfied himself by various investigations and experi-

ments that they were simply suffering from hysteria. One of his investigations is especially curious. In order to observe the patients more carefully, he invited some of them to dine with him, gave them without their knowledge holy water in their wine or their food, and found that it produced no effect whatever, though its results upon the demons when the possessed knew of its presence had been very strikingly marked. Even after plentiful doses of holy water had been thus given, the possessed remained afflicted, urged that the devil should be cast out, and some of them even went into convulsions, the devil apparently speaking from their mouths. It was evident that Satan had not the remotest idea that he had been thoroughly dosed with the most effective medicine known to the older theology.*

At last Tissot published the results of his experiments, and the stereotyped answer was soon made. It resembled the answer made by the clerical opponents of Galileo when he showed them the moons of Jupiter through his telescope, and they declared that the moons were created by the telescope. The clerical opponents of Tissot declared that the non-effect of the holy water upon the demons proved nothing save the extraordinary cunning of Satan; that the arch-fiend wishes it to be thought that he does not exist, and so overcame his repugnance to holy water, gulping it down in order to conceal his presence.

Dr. Tissot also examined into the gift of tongues exercised by the possessed. As to German and Latin, no great difficulty was presented: it was by no means hard to suppose that some of the girls might have learned some words of the former language in the neighboring Swiss cantons where German was spoken, or even in Germany itself; and as to Latin, considering that they had heard it from their childhood in the church, there seemed nothing very wonderful in their uttering some words in that language also. As to Arabic, had they really spoken it, that might have been accounted for by the relations of the possessed with Zouaves or Spahis from the French army; but, as Tissot could discover no such relations, he investigated this point as the most puzzling of all.

On a close inquiry he found that all the wonderful examples of speaking Arabic were reduced to one. He then asked whether there was any other person speaking or knowing Arabic in the town. He was answered that there was not. He asked whether any person had lived there, so far as any one could remember, who had spoken or understood Arabic, and he was answered in the negative. He then asked the witnesses how they knew that the language spoken by the girl was Arabic; no answer was vouch-

* For an amazing delineation of the curative and other virtues of holy water, see the Abbé Gaume, "L'Eau bénite au XIX^me^ Siècle," Paris, 1863.

safed him, but he was overwhelmed with such stories as that of a pig which, at sight of the cross on the village church, suddenly refused to go further—and he was denounced thoroughly in the clerical newspapers for declining to accept such evidence.

At Tissot's visit in 1863 the possession had generally ceased, and the cases left were few and quiet. But his visits stirred a new controversy, and its echoes were long and loud in the pulpits and clerical journals. Believers insisted that Satan had been removed by the intercession of the Blessed Virgin; unbelievers hinted that the main cause of the deliverance was the reluctance of the possessed to be shut up in asylums.

Under these circumstances the Bishop of Annecy announced that he would visit Morzines to administer confirmation, and word appears to have spread that he would give a more orthodox completion to the work already done by exorcising the devils who remained. Immediately several new cases of possession appeared; young girls who had been cured were again affected; the embers thus kindled were fanned into a flame by a "mission" which sundry priests held in the parish to arouse the people to their religious duties—a mission, in Roman Catholic countries, being akin to the "revivals" among some Protestant sects. Multitudes of young women, excited by the preaching and appeals of the clergy, were again thrown into the old disease, and at the coming of the good bishop it culminated.

The account is given in the words of an eye-witness:

"At the solemn entrance of the bishop into the church, the possessed persons threw themselves on the ground before him, or endeavored to throw themselves upon him, screaming frightfully, cursing, blaspheming, so that the people at large were struck with horror. The possessed followed the bishop, hooted him, and threatened him, up to the middle of the church; order was only established by the intervention of the soldiers. During the confirmation the diseased redoubled their howls and infernal vociferations, and tried to spit in the face of the bishop and to tear off his pastoral raiment. At the moment when the prelate gave his benediction a still more outrageous scene took place. The violence of the diseased was carried to fury, and from all parts of the church arose yells and fearful howling; so frightful was the din that tears fell from the eyes of many of the spectators, and many strangers were thrown into consternation."

Among the very large number of these diseased persons there were only two men; of the remainder only two were of advanced age. The great majority were young women between the ages of eighteen and twenty-five years.

The public authorities shortly afterward intervened and sought to cure the disease and to draw the people out of their mania by

singing, dancing, and sports of various sorts, until at last it was brought under control.*

Scenes similar to these, in their essential character, have arisen more recently in Protestant countries, but with the difference that what has been generally attributed by Roman Catholic ecclesiastics to Satan is attributed by Protestant ecclesiastics to the Almighty. Typical among the greater exhibitions of this were those which began in the Methodist chapel at Redruth in Cornwall—convulsions, leaping, jumping, until some four thousand persons were seized by it. The same thing is seen in the ruder parts of America at "revivals" and camp-meetings.

And in still another great field these exhibitions are seen, but more after a mediæval pattern. In the Tigretier of Abyssinia we have epidemics of dancing which seek and obtain miraculous cures.

Reports of similar manifestations are also sent from missionaries from the west coast of Africa, one of whom sees in some of them the characteristics of cases of possession mentioned in our Gospels, and is therefore inclined to attribute them to Satan.†

But happily, long before these latter occurrences, science had come into the field and was gradually diminishing this class of diseases. Among the earlier workers to this better purpose was the great Dutch physician Boerhaave. Finding in one of the wards in the hospital at Haarlem a number of women going into convulsions and imitating each other in various acts of frenzy, he immediately ordered a furnace of blazing coals into the midst of the ward, heated cauterizing irons, and declared he would burn the arms of the first woman who fell into convulsions. No more cases occurred.‡

These and similar successful dealings of medical science with mental disease brought about the next stage in the theological development. The Church sought to retreat, after the usual manner, behind a compromise. Early in the eighteenth century appeared a new edition of the great work by the Jesuit Delrio which for a hundred years had been a text-book for the use of ecclesiastics in fighting witchcraft. But in this edition the part played by Satan in diseases was changed. It was suggested that, while diseases have natural causes, it is necessary that Satan enter the human body in order to make these causes effective. Delrio claims that

* See Tissot, "L'Imagination: ses Bienfaits et ses Égarements surtout dans le Domaine du Merveilleux," Paris, 1858, par. 7; "Les Possédés de Morzines"; also Constans, "Relation sur une Epidémie de Hystéro-Démonopathie," Paris, 1863.

† For the Tigretier, with especially interesting citations, see Hecker's "Essay," chap. iii, sec. 1; for the cases in western Africa, see the Rev. J. L. Wilson, "Western Africa," p. 217.

‡ See Figuier, "Histoire du Merveilleux," vol. i, p. 402.

Satan "attacks lunatics at the full moon, when their brains are full of humors," that in other cases of illness he "stirs the black bile," and that in cases of blindness and deafness he "clogs the eyes and ears." By the close of the century this compromise was evidently found untenable, and one of a very different sort was attempted in England.

In the third edition of the "Encyclopædia Britannica," published in 1797, under the article "Dæmoniacs," the orthodox view was presented in the following words: "The reality of demoniacal possession stands upon the same evidence with the gospel system in general."

This statement, though necessary to satisfy the older theological sentiment, was clearly found too dangerous to be sent out into the modern skeptical world without some qualification. Another view was therefore suggested, namely, that the personages of the New Testament "adopted the vulgar language in speaking of those unfortunate persons who were generally imagined to be possessed with demons." Two or three editions contained this curious compromise; but, as we come to the middle of the present century, the whole discussion is quietly dropped.

But science, declining to trouble itself with any of these views, pressed on, and toward the end of the century we see Dr. Rhodes at Lyons curing a very serious case of possession by the use of a powerful emetic; yet myth-making came in here also, and it was stated that, when the emetic produced its effect, people had seen multitudes of green and yellow devils cast forth from the mouth of the possessed.

The last great demonstration of the old belief in England was made in 1788. In the city of Bristol at that time lived a drunken epileptic, George Lukins. In asking alms he insisted that he was "possessed," and proved it by jumping, screaming, barking, and treating the company to a parody of the "Te Deum."

He was solemnly brought into the Temple Church, and seven clergymen united in the effort to exorcise the evil spirit. Upon their adjuring Satan, he swore "by his infernal den" that he would not come out of the man—"an oath," says the chronicler, "nowhere to be found but in Bunyan's 'Pilgrim's Progress,' from which Lukins probably got it."

But the seven clergymen were at last successful, and seven devils were cast out, after which Lukins retired, and appears to have been supported during the remainder of his life as a monument of mercy.

With this great effort the old theory in England seemed practically exhausted.

Science had evidently carried the stronghold. In 1876, at a little town near Amiens, in France, a young woman was brought

to the priest, suffering terribly with all the usual evidences of diabolic possession. The priest was besought to cast out the devil, but he simply took her to the hospital, where, under scientific treatment, she rapidly became better.*

The final triumph of science in this part of the great field has been mainly achieved during the latter half of the present century.

Following in the noble succession of Paracelsus and John Hunter and Pinel and Tuke and Esquirol, have come a band of thinkers and workers who have evolved out of the earlier forms of truths new growths, ever more and more precious.

Among the many facts and principles thus brought to bear upon this last stronghold of the Prince of Darkness, may be named especially those of "expectant attention," an expectation of phenomena dwelt upon until the longing for them becomes morbid and invincible, and the creation of them perhaps unconscious. Still another class of phenomena are found to arise from a morbid tendency to imitation which leads to epidemics. Still another group has been brought under hypnotism. Multitudes more have been found under the innumerable forms and results of hysteria. A study of the effects of the imagination upon bodily function has also yielded remarkable results.

And, finally, to supplement this work, have come in an array of scholars in history and literature who have investigated myth-making and wonder-mongering.

Thus has been cleared away that cloud of supernaturalism which so long hung over mental diseases, and thus have they been brought within the firm grasp of science.†

* See Figuier; also Collin de Plancy, "Dictionnaire Infernale," article Possédés.

† To go even into leading citations in this vast and beneficent literature would take me far beyond my plan and space, but I may name, among leading and easily accessible authorities, Brierre de Boismont on "Hallucinations," Hulme's translation, 1860; also James Braid, "The Power of the Mind over the Body," London, 1846; Krafft-Ebing, "Lehrbuch der Psychiatrie," Stuttgart, 1888; Tuke, "Influence of the Mind on the Body," London, 1884; Maudsley, "Pathology of the Mind," London, 1879; Carpenter, "Mental Physiology," sixth edition, London, 1888; Lloyd Tuckey, "Faith Cure," Nineteenth Century Magazine for December, 1888; Pettigrew, "Superstitions connected with the Practice of Medicine and Surgery," London, 1844.

As to myth-making and wonder-mongering, the general reader will find interesting supplementary accounts in the recent works of Andrew Lang and Baring-Gould.

A very curious evidence of the effects of the myth-making tendency has recently come to the attention of the writer of this article. Periodically, for many years past, we have seen, in books of travel and in the newspapers, accounts of the wonderful performances of the jugglers in India; of the stabbing of a child in a small basket in the midst of an arena, and the child appearing alive in the surrounding crowd; of seeds planted, sprouted, and becoming well-grown trees under the hand of the juggler; of ropes thrown into the air and sustained by invisible force. A short time since Count de Gubernatis, the eminent professor and Oriental scholar at Florence, informed the present writer that he had recently seen and studied these exhibitions, and that, so far from being wonderful, they were much inferior to the jugglery so well known in all our Western capitals.

Conscientious men still linger on who find comfort in holding fast to some shred of the old belief in diabolic possession. The sturdy declaration in the last century by John Wesley, that "giving up witchcraft is giving up the Bible," is echoed feebly in the latter half of this century by the eminent Catholic ecclesiastic in France who declares that "to deny possession by devils is to charge Jesus and his apostles with imposture," and asks, "How can the testimony of apostles, fathers of the Church, and saints who saw the possessed and so declared, be denied?" And a still fainter echo lingers in Protestant England.*

But, despite this conscientious opposition, science has in these latter days steadily wrought hand in hand with Christian charity in this field, to evolve a better future for humanity. The thoughtful physician and the devoted clergyman are now constantly seen working together; and it is not too much to expect that Satan, having been cast out of the insane asylums, will ere long disappear from monasteries and camp-meetings, even in the most unenlightened regions of Christendom.

GLACIERS ON THE PACIFIC COAST.†

By G. FREDERICK WRIGHT, D. D., LL. D.

NORTHWARD from Washington Territory the coast is everywhere very rugged, being formed by the lofty peaks of an extension of the Cascade Range; while the thousands of islands which fringe the coast of British Columbia and Alaska are but the partially submerged peaks of an extension of the Coast Range, from which the great glaciers of former times have scraped off nearly all the fertile soil. It is estimated that there are ten thousand islands between Washington Territory and Mount St. Elias, and all the larger of them bear snow-covered summits during the whole year. The water in the narrow channels separating these islands is ordinarily several hundred feet deep, affording, through nearly the whole distance, a protected channel for navigation.

Three great rivers interrupt the mountain barrier of British Columbia facing the Pacific—the Fraser, the Skeena, and the Stickeen—and the interior is penetrated for some distance by innumerable fiords. The Canadian Pacific Railroad follows the course of the Fraser for a long distance, and passes within sight of glaciers of considerable extent, and every fiord receives the drainage

* See the Abbé Barthélemi, in the "Dictionnaire de la Conversation"; also the Rev. W. Scott's "Doctrine of Evil Spirits proved," London, 1857.

† From advance sheets of "The Ice Age in North America, and its Bearings on the Antiquity of Man." In press of D. Appleton & Co.

of numerous decaying glaciers. But it is not until reaching the Stickeen River, in Alaska, in latitude 57°, that glaciers begin to

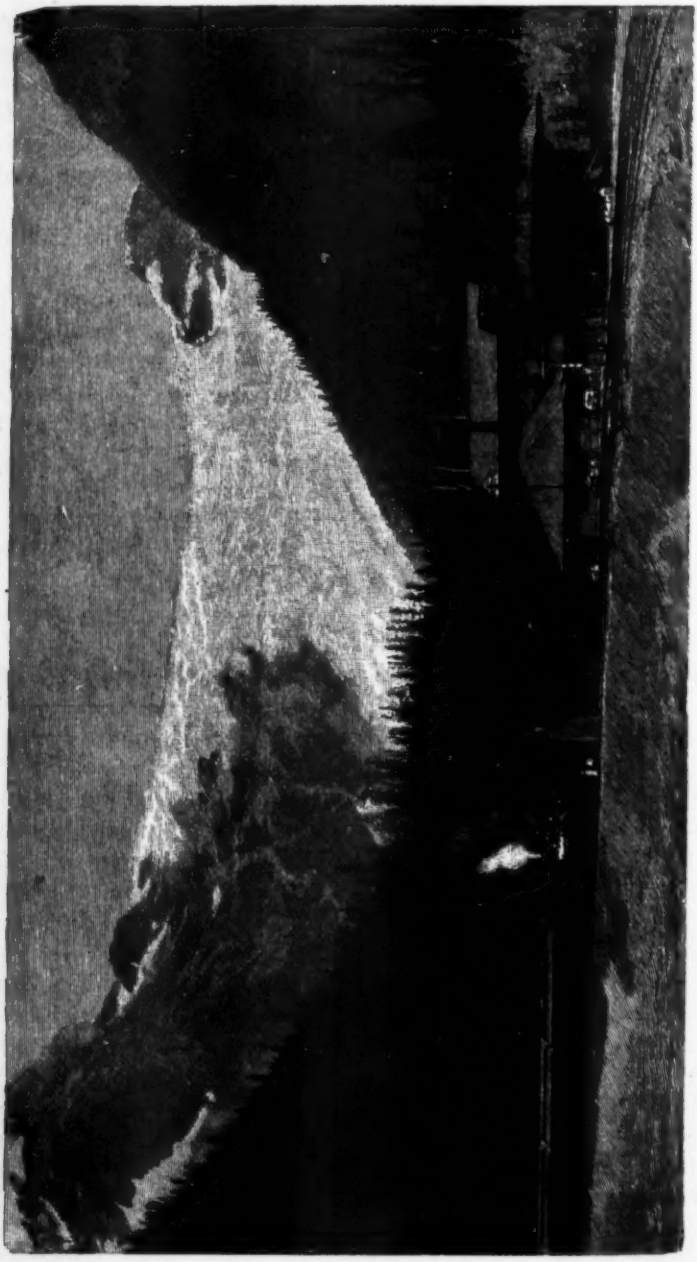


FIG. 1.—GLACIER STATION, SELKIRK MOUNTAINS, BRITISH COLUMBIA. (Courtesy of the Canadian Pacific Railroad.)

appear which are both easily accessible and large enough to invite protracted study. The water coming into the sound from the Stick-

een River is heavily charged with glacial mud, which spreads itself out over a great expanse. An extensive delta, forming almost the

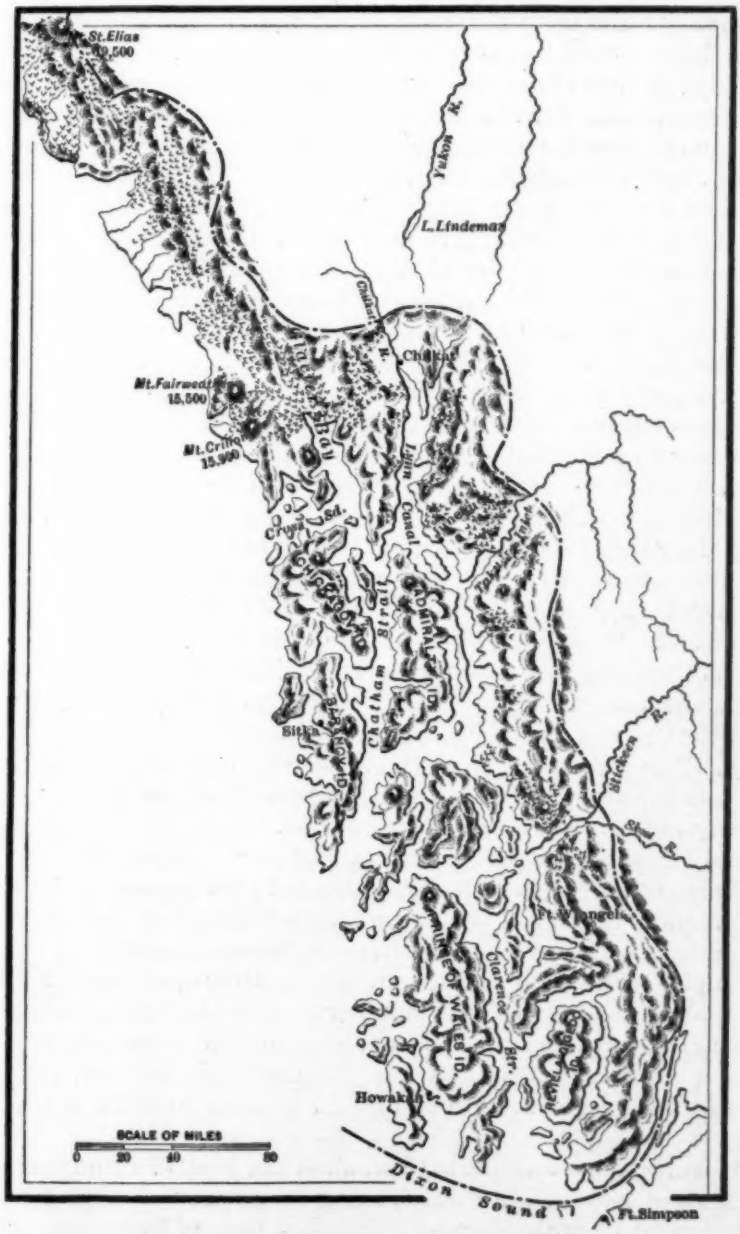


FIG. 2.—MAP OF SOUTHEASTERN ALASKA. The arrow-points mark glaciers.

only arable land in southeastern Alaska, has been built up by the deposit at the mouth of this river. The most accurate information

yet obtained concerning these glaciers is that gathered by Mr. William P. Blake in 1863. According to him, "there are four large glaciers and several smaller ones visible within a distance of sixty or seventy miles from the mouth" of the river. The second of these larger ones has attracted most attention. This "sweeps grandly out into the valley from an opening between high mountains from a source that is not visible. It ends at the level of the river in an irregular bluff of ice, a mile and a half or two miles in length, and about one hundred and fifty feet high. Two or more terminal moraines protect it from the direct action of the stream. What at first appeared as a range of ordinary hills along the river, proved on landing to be an ancient terminal moraine, crescent-shaped and covered with a forest. It extends the full length of the front of the glacier."*

This glacier has never been fully explored. A number of years since, a party of Russian officers attempted its exploration, and were never heard from again. Mr. Blake reports that, as usual with receding glaciers, a considerable portion of the front as it spreads out in the valley is so covered with bowlders, gravel, and mud that it is difficult to tell where the glacier really ends. But from the valley to the higher land it rises in precipitous, irregular, stair-like blocks, with smooth sides, and so large that it was impossible to surmount them with the ordinary equipment of explorers. The glacier is estimated to be about forty miles long.

Another glacier, upon the opposite side of the river, of which Mr. Blake does not speak, was reported to me by those familiar with the country as coming down to within about two miles of the bank. The Indians are very likely correct in asserting that these two glaciers formerly met, compelling the Stickeen River to find its way to the sea through a vast tunnel. It would then have appeared simply as a subglacial stream of great magnitude.

North of the Stickeen River, glaciers of great size are of increasing frequency, and can be seen to good advantage from the excursion steamer. The Auk and Patterson glaciers appear first, not far north of Fort Wrangel. On approaching Holkham Bay and Taku Inlet, about latitude 58°, the summer tourist has, in the numerous icebergs encountered, pleasing evidence of the proximity of still greater glaciers coming down to the sea-level. Indeed, the glaciers of Taku Inlet are second only in interest to those of Glacier Bay.

In going from Juneau to Chilkat, at the head of Lynn Canal, a distance of about eighty miles, nineteen glaciers of large size are in full sight from the steamer's deck, but none of them come down far enough to break off into the water and give birth to icebergs. The Davidson Glacier, however, comes down just to the water's

* "American Journal of Science," vol. xciv, 1867, pp. 96–101.

edge, and has there built up an immense terminal moraine all along its front.

An illustration of the precipitous character of the southeastern coast of Alaska is seen in the fact that it is only thirty-five miles

FIG. 8.—NORRIS GLACIER, TAKU INLET, ALASKA. Showing icebergs that have broken off from the front. Front about one mile wide. (Photograph by Partridge.)

from the head of Lynn Canal to the sources of the Yukon River, which then flows to the north and west for nearly three thousand miles before coming down to the sea-level. Lieutenant Schwatka

reports four glaciers of considerable size in the course of this short portage between Chilkat and Lake Lindeman.* The vast region through which the Yukon flows to the north of these mountains is not known to contain any extensive glaciers. But, according to the reports of Dall, Schwatka, and others, it is a most inhospitable country, where human life can be maintained only with the greatest difficulty; where the thermometer sinks to 60° below zero in winter, and rises for a short period to 120° in the summer; and where the ground remains perpetually frozen at a short depth below the surface.

FIG. 4.—DAVIDSON GLACIER, NEAR CHILKAT, ALASKA, LATITUDE 59° 45′. The mountains are from five thousand to seven thousand feet high; the gorge about three quarters of a mile wide; the front of the glacier, three miles; the terminal moraine, about two hundred and fifty feet high. (View from two miles distant.)

From Cross Sound, about latitude 58° and longitude 136° west from Greenwich, to the Alaskan Peninsula, the coast is bordered by a most magnificent semicircle of mountains opening to the south, and extending for more than a thousand miles. Throughout this whole extent, glaciers of large size are everywhere to be seen. Elliott † estimates that, counting great and small, there can not be less than five thousand glaciers between Dixon's Entrance and the extremity of the Alaskan Peninsula.

Little is known in detail of the glaciers of this region. But those in the neighborhood of Mount St. Elias are evidently the largest anywhere to be found in the northern hemisphere outside of Greenland. This mountain rises 19,500 feet above the sea; and Lieutenant Schwatka, in his expedition of 1886, reported eleven glaciers as coming down from its southern side. One of these,

* "Science," vol. iii (February 22, 1884), pp. 220–227.

† See "Our Arctic Province," p. 91.

which is named the Agassiz Glacier, he estimates to be twenty miles in width and fifty miles in length, and to cover an area of a thousand square miles. Another, which he named Guyot Glacier, seemed to be about the same in dimensions. These come down to the sea-level in Icy Bay, and present a solid ice wall many miles in extent, which is continually breaking off into icebergs of great size.*

Vancouver's account of the glacial phenomena along this coast is still both instructive and interesting, and in places curious:

"Between these points (Pigot and Pakenham) a bay is formed, about a league and a half deep toward the north-northwest, in which were seen several shoals and much ice; the termination of this bay is bounded by a continuation of the above range of lofty mountains. On this second low projecting point, which Mr. Whidbey called 'Point Pakenham,' the latitude was observed to be 60° 59½′, its longitude 212° 29′. The width of the arm at this station was reduced to two miles, in which were several half-concealed rocks, and much floating ice, through which they pursued their examination, to a point at the distance of three miles along the western shore, which still continued to be compact, extending north 30° east; in this direction they met such innumerable huge bodies of ice, some afloat, others lying on the ground near the shore in ten or twelve fathoms water, as rendered their further progress up the branch rash and highly dangerous. This was, however, very fortunately, an object of no moment, since before their return they had obtained a distinct view of its termination, about two leagues farther in the same direction, by a firm and compact body of ice reaching from side to side, and greatly above the level of the sea; behind which extended the continuation of the same range of lofty mountains, whose summits seemed to be higher than any that had yet been seen on the coast.

"While at dinner in this situation they frequently heard a very loud, rumbling noise, not unlike loud but distant thunder; similar sounds had often been heard when the party was in the neighborhood of large bodies of ice, but they had not before been able to trace the cause. They now found the noise to originate from immense ponderous fragments of ice, breaking off from the higher parts of the main body, and falling from a very considerable height, which in one instance produced so violent a shock that it was sensibly felt by the whole party, although the ground on which they were was at least two leagues from the spot where the fall of ice had taken place. . . .

"The base of this lofty range of mountains (between Elias and Fairweather) now gradually approached the sea-side; and to the southward of Cape Fairweather it may be said to be washed by the ocean; the interruption in the summit of these very elevated

* "New York Times," November 14, 1886.

mountains, mentioned by Captain Cook, was likewise conspicuously evident to us as we sailed along the coast this day, and looked like a plain composed of a solid mass of ice or frozen snow, inclining gradually toward the low border; which from the smoothness, uniformity, and clean appearance of its surface, conveyed the idea of extensive waters having once existed beyond the then limits of our view, which had passed over this depressed part of the mountains, until their progress had been stopped by the severity of the climate, and that, by the accumulation of succeeding snow, freezing on this body of ice, a barrier had become formed that had prevented such waters from flowing into the sea. This is not the only place where we had noticed the like appearance; since passing the icy bay mentioned on the 28th of June, other valleys had been seen strongly resembling this, but none were so extensive, nor was the surface of any of them so clean, most of them appearing to be very dirty. I do not, however, mean to assert that these inclined planes of ice must have been formed by the passing of inland waters thus into the ocean, as the elevation of them, which must be many hundred yards above the level of the sea, and their having been doomed for ages to perpetual frost, operate much against this reasoning; but one is naturally led, on contemplating any phenomenon out of the ordinary course of nature, to form some conjecture and to hazard some opinion as to its origin, which on the present occasion is rather offered for the purpose of describing its appearance, than accounting for the cause of its existence." *

Beyond Mount St. Elias, in the neighborhood of the Copper River and Prince William Sound, glaciers are reported by Elliott as numerous and of great size. Mount Wrangel, in the forks of the Copper River, is estimated by him to be upward of twenty thousand feet in height. From the flanks of the Chugatch Alps, of which Wrangel is the eastern summit, immense glaciers descend to Prince William Sound, and add greatly to the gloomy grandeur of its scenery. Glaciers also extend throughout the Kenai and Alaskan Peninsulas, as far to the westward as longitude 162°, and one even has been observed upon the island of Unalaska.

The region in the interior north of the St. Elias and Chugatch Alps has been but imperfectly explored; but there seems pretty general agreement that there are no glaciers there at the present time, nor is there evidence that glaciers ever existed in the country. Much of the region is now covered with *tundra*—that is, with vast level areas which are so deeply frozen that they never thaw out below a few feet from the surface. These are covered with a dense growth of heath and arctic mosses, which afford food for the reindeer, but are useless for man.

* "Voyage of Discovery around the World," vol. v, pp. 312–314, 358–360.

At Eschscholtz Bay, on Kotzebue Sound, in latitude 66° 15', Kotzebue discovered in 1818 a cliff of frozen mud and ice "capped by a few feet of soil bearing moss and grass."* Large numbers of bones of the "mammoth, bison (?), reindeer, moose-deer, musk-ox, and horse, were found" at the base, where they had fallen down from the cliff during the summer thaw. Sir Edward Belcher and Mr. G. B. Seeman afterward visited the same spot and corroborated Kotzebue's account. From their report it was evident that the conditions in northern Alaska are very similar to those in northern Siberia, where so many similar remains of extinct and other animals have been found in the frozen soil. The section described at Eschscholtz Bay seems to be simply the edge of the *tundra* which is so largely represented in the central portions of the Territory.

AGNOSTICISM: A REJOINDER.

By Prof. T. H. HUXLEY, F. R. S.

THE concluding paragraph of the Bishop of Peterborough's reply to the appeal which I addressed to him in the penultimate number of this review, leads me to think that he has seen a personal reference where none was intended. I had ventured to suggest that the demand that a man should call himself an infidel, savored very much of the flavor of a "bull"; and, even had the Right Reverend prelate been as stolid an Englishman as I am, I should have entertained the hope, that the oddity of talking of the cowardice of persons who object to call themselves by a nickname, which must in their eyes be as inappropriate as, in the intention of the users, it is offensive, would have struck him. But, to my surprise, the bishop has not even yet got sight of that absurdity. He thinks, that if I accept Dr. Wace's definition of his much-loved epithet, I am logically bound not only to adopt the titles of infidel and miscreant, but that I shall "even glory in those titles." As I have shown, "infidel" merely means somebody who does not believe what you believe yourself, and therefore Dr. Wace has a perfect right to call, say, my old Egyptian donkey-driver, Nooleh, and myself, infidels, just as Nooleh and I have a right to call him an infidel. The ludicrous aspect of the thing comes in only when either of us demands that the two others should so label themselves. It is a terrible business to have to explain a mild jest, and I pledge myself not to run the risk of offending in this way again. I see how wrong I was in trusting to the bishop's sense of the ludicrous, and I beg leave unreservedly to withdraw my misplaced confidence. And I take this course the more readily as there is

* See Prestwich's "Geology," vol. ii, p. 463 *et seq.*

something about which I am obliged again to trouble the Bishop of Peterborough, which is certainly no jesting matter. Referring to my question, the bishop says that if they (the terms "infidel" and "miscreant")

should not be so proved to be applicable, then I should hold it to be as unreasonable to expect him to call himself by such names as he, I suppose, would hold it to be to expect us Christians to admit, without better reason than he has yet given us, that Christianity is "the sorry stuff" which, with his "profoundly" moral readiness to say "unpleasant" things, he is pleased to say that it is.*

According to those "English modes of thought and expression," of which the bishop seems to have but a poor opinion, this is a deliberate assertion that I had said that Christianity is "sorry stuff." And, according to the same standard of fair dealing, it is, I think, absolutely necessary for the Bishop of Peterborough to produce the evidence on which this positive statement is based. I shall be unfeignedly surprised if he is successful in proving it; but it is proper for me to wait and see.

Those who passed from Dr. Wace's article in the last number of this review to the anticipatory confutation of it which followed in "The New Reformation," must have enjoyed the pleasure of a dramatic surprise—just as when the fifth act of a new play proves unexpectedly bright and interesting. Mrs. Ward will, I hope, pardon the comparison, if I say that her effective clearing away of antiquated incumbrances from the lists of the controversy reminds me of nothing so much as of the action of some neat-handed, but strong-wristed, Phyllis, who, gracefully wielding her long-handled "Turk's head," sweeps away the accumulated results of the toil of generations of spiders. I am the more indebted to this luminous sketch of the results of critical investigation, as it is carried out among those theologians who are men of science and not mere counsel for creeds, since it has relieved me from the necessity of dealing with the greater part of Dr. Wace's polemic, and enables me to devote more space to the really important issues which have been raised.†

Perhaps, however, it may be well for me to observe that approbation of the manner in which a great biblical scholar, for instance Reuss, does his work does not commit me to the adoption of all, or indeed of any of his views; and, further, that the disagreements of a series of investigators do not in any way interfere with the fact that each of them has made important contributions to the

* "Popular Science Monthly" for May, 1889, p. 83.

† I may perhaps return to the question of the authorship of the Gospels. For the present I must content myself with warning my readers against any reliance upon Dr. Wace's statements as to the results arrived at by modern criticism. They are as gravely as surprisingly erroneous.

body of truth ultimately established. If I cite Buffon, Linnæus, Lamarck, and Cuvier, as having each and all taken a leading share in building up modern biology, the statement that every one of these great naturalists disagreed with, and even more or less contradicted, all the rest is quite true; but the supposition that the latter assertion is in any way inconsistent with the former, would betray a strange ignorance of the manner in which all true science advances.

Dr. Wace takes a great deal of trouble to make it appear that I have desired to evade the real questions raised by his attack upon me at the Church Congress. I assure the reverend principal that in this, as in some other respects, he has entertained a very erroneous conception of my intentions. Things would assume more accurate proportions in Dr. Wace's mind if he would kindly remember that it is just thirty years since ecclesiastical thunderbolts began to fly about my ears. I have had the "Lion and the Bear" to deal with, and it is long since I got quite used to the threatenings of episcopal Goliaths, whose crosiers were like unto a weaver's beam. So that I almost think I might not have noticed Dr. Wace's attack, personal as it was; and although, as he is good enough to tell us, separate copies are to be had for the modest equivalent of twopence, as a matter of fact, it did not come under my notice for a long time after it was made. May I further venture to point out that (reckoning postage) the expenditure of twopence-halfpenny, or, at the most, threepence, would have enabled Dr. Wace so far to comply with ordinary conventions as to direct my attention to the fact that he had attacked me before a meeting at which I was not present? I really am not responsible for the five months' neglect of which Dr. Wace complains. Singularly enough, the Englishry who swarmed about the Engadine, during the three months that I was being brought back to life by the glorious air and perfect comfort of the Maloja, did not, in my hearing, say anything about the important events which had taken place at the Church Congress; and I think I can venture to affirm that there was not a single copy of Dr. Wace's pamphlet in any of the hotel libraries which I rummaged in search of something more edifying than dull English or questionable French novels.

And now, having, as I hope, set myself right with the public as regards the sins of commission and omission with which I have been charged, I feel free to deal with matters to which time and type may be more profitably devoted.

The Bishop of Peterborough indulges in the anticipation that Dr. Wace will succeed in showing me "that a scientist dealing with questions of theology or biblical criticism may go quite as far astray as theologians often do in dealing with questions

of science."* I have already admitted that vaticination is not in my line; and I can not so much as hazard a guess whether the spirit of prophecy which has descended on the bishop comes from the one or the other of the two possible sources recognized by the highest authorities. But I think it desirable to warn those who may be misled by phraseology of this kind, that the antagonists in the present debate are not quite rightly represented by it. Undoubtedly, Dr. Wace is a theologian; and I should be the last person to question that his whole cast of thought and style of argumentation are pre-eminently and typically theological. And, if I must accept the hideous term "scientist" (to which I object even more than I do to "infidel"), I am ready to admit that I am one of the people so denoted.

But I hope and believe that there is not a solitary argument I have used, or that I am about to use, which is original, or has anything to do with the fact that I have been chiefly occupied with natural science. They are all, facts and reasoning alike, either identical with, or consequential upon, propositions which are to be found in the works of scholars and theologians of the highest repute in the only two countries, Holland and Germany,† in which, at the present time, professors of theology are to be found, whose tenure of their posts does not depend upon the results to which their inquiries lead them.‡

It is true that, to the best of my ability, I have satisfied myself of the soundness of the foundations on which my arguments are built, and I desire to be held fully responsible for everything I say. But, nevertheless, my position is really no more than that of an expositor; and my justification for undertaking it is simply that conviction of the supremacy of private judgment (indeed, of the impossibility of escaping it) which is the foundation of the Protestant Reformation, and which was the doctrine accepted by the vast majority of the Anglicans of my youth, before that backsliding toward the "beggarly rudiments" of an effete and idolatrous sacerdotalism which has, even now, provided us with

* "Popular Science Monthly" for May, 1889, p. 84.

† The United States ought, perhaps, to be added, but I am not sure.

‡ Imagine that all our chairs of Astronomy had been founded in the fourteenth century, and that their incumbents were bound to sign Ptolemaic articles. In that case, with every respect for the efforts of persons thus hampered to attain and expound the truth, I think men of common sense would go elsewhere to learn astronomy. Zeller's "Vorträge und Abhandlungen" were published and came into my hands a quarter of a century ago. The writer's rank, as a theologian to begin with, and subsequently as a historian of Greek philosophy, is of the highest. Among these essays are two—"Das Urchristenthum" and "Die Tübinger historische Schule"—which are likely to be of more use to those who wish to know the real state of the case than all that the official "apologists," with their one eye on truth and the other on the tenets of their sect, have written. For the opinion of a scientific theologian about theologians of this stamp see pp. 225 and 227 of the "Vorträge."

the saddest spectacle which has been offered to the eyes of Englishmen in this generation. A high court of ecclesiastical jurisdiction, with a host of great lawyers in battle array, is and, for Heaven knows how long, will be, occupied with these very questions of "washings of cups and pots and brazen vessels," which the Master, whose professed representatives are rending the Church over these squabbles, had in his mind when, as we are told, he uttered the scathing rebuke:

> Well did Isaiah prophesy of you hypocrites, as it is written:
> This people honoreth me with their lips,
> But their heart is far from me:
> But in vain do they worship me,
> Teaching as their doctrines the precepts of men (Mark vii, 6, 7).

Men who can be absorbed in bickerings over miserable disputes of this kind can have but little sympathy with the old evangelical doctrine of the "open Bible," or anything but a grave misgiving of the results of diligent reading of the Bible, without the help of ecclesiastical spectacles, by the mass of the people. Greatly to the surprise of many of my friends, I have always advocated the reading of the Bible, and the diffusion of the study of that most remarkable collection of books among the people. Its teachings are so infinitely superior to those of the sects, who are just as busy now as the Pharisees were eighteen hundred years ago, in smothering them under "the precepts of men"; it is so certain, to my mind, that the Bible contains within itself the refutation of nine tenths of the mixture of sophistical metaphysics and old-world superstition which has been piled round it by the so-called Christians of later times; it is so clear that the only immediate and ready antidote to the poison which has been mixed with Christianity, to the intoxication and delusion of mankind, lies in copious draughts from the undefiled spring, that I exercise the right and duty of free judgment on the part of every man, mainly for the purpose of inducing other laymen to follow my example. If the New Testament is translated into Zulu by Protestant missionaries, it must be assumed that a Zulu convert is competent to draw from its contents all the truths which it is necessary for him to believe. I trust that I may, without immodesty, claim to be put on the same footing as the Zulu.

The most constant reproach which is launched against persons of my way of thinking is, that it is all very well for us to talk about the deductions of scientific thought, but what are the poor and the uneducated to do? Has it ever occurred to those who talk in this fashion that the creeds and articles of their several confessions; their determination of the exact nature and extent of the teachings of Jesus; their expositions of the real meaning of that which is written in the Epistles (to leave aside all questions con-

cerning the Old Testament) are nothing more than deductions, which, at any rate, profess to be the result of strictly scientific thinking, and which are not worth attending to unless they really possess that character? If it is not historically true that such and such things happened in Palestine eighteen centuries ago, what becomes of Christianity? And what is historical truth but that of which the evidence bears strict scientific investigation? I do not call to mind any problem of natural science which has come under my notice, which is more difficult, or more curiously interesting as a mere problem, than that of the origin of the synoptic Gospels and that of the historical value of the narratives which they contain. The Christianity of the churches stands or falls by the results of the purely scientific investigation of these questions. They were first taken up in a purely scientific spirit just about a century ago; they have been studied, over and over again, by men of vast knowledge and critical acumen; but he would be a rash man who should assert that any solution of these problems, as yet formulated, is exhaustive. The most that can be said is that certain prevalent solutions are certainly false, while others are more or less probably true.

If I am doing my best to rouse my countrymen out of their dogmatic slumbers, it is not that they may be amused by seeing who gets the best of it, in a contest between a "scientist" and a theologian. The serious question is whether theological men of science, or theological special pleaders, are to have the confidence of the general public; it is the question whether a country in which it is possible for a body of excellent clerical and lay gentlemen to discuss, in public meeting assembled, how much it is desirable to let the congregations of the faithful know of the results of biblical criticism, is likely to wake up with anything short of the grasp of a rough lay hand upon its shoulder; it is the question whether the New Testament books, being as I believe they were, written and compiled by people who, according to their lights, were perfectly sincere, will not, when properly studied as ordinary historical documents, afford us the means of self-criticism. And it must be remembered that the New Testament books are not responsible for the doctrine invented by the churches that they are anything but ordinary historical documents. The author of the third Gospel tells us as straightforwardly as a man can that he has no claim to any other character than that of an ordinary compiler and editor, who had before him the works of many and variously qualified predecessors.

In my former papers, according to Dr. Wace, I have evaded giving an answer to his main proposition, which he states as follows:

Apart from all disputed points of criticism, no one practically doubts that our Lord lived and that he died on the cross, in the most intense sense of filial relation to his Father in heaven, and that he bore testimony to that Father's providence, love, and grace toward mankind. The Lord's Prayer affords a sufficient evidence on these points. If the Sermon on the Mount alone be added, the whole unseen world, of which the agnostic refuses to know anything, stands unveiled before us. . . . If Jesus Christ preached that sermon, made those promises, and taught that prayer, then any one who says that we know nothing of God, or of a future life, or of an unseen world, says that he does not believe Jesus Christ.*

Again—

The main question at issue, in a word, is one which Prof. Huxley has chosen to leave entirely on one side—whether, namely, allowing for the utmost uncertainty on other points of the criticism to which he appeals, there is any reasonable doubt that the Lord's Prayer and the Sermon on the Mount afford a true account of our Lord's essential belief and cardinal teaching.†

I certainly was not aware that I had evaded the questions here stated; indeed, I should say that I have indicated my reply to them pretty clearly; but, as Dr. Wace wants a plainer answer, he shall certainly be gratified. If, as Dr. Wace declares it is, his "whole case is involved in" the argument as stated in the latter of these two extracts, so much the worse for his whole case. For I am of opinion that there is the gravest reason for doubting whether the "Sermon on the Mount" was ever preached, and whether the so-called "Lord's Prayer" was ever prayed by Jesus of Nazareth. My reasons for this opinion are, among others, these: There is now no doubt that the three synoptic Gospels, so far from being the work of three independent writers, are closely interdependent,‡ and that in one of two ways. Either all three contain, as their foundation, versions, to a large extent verbally identical, of one and the same tradition; or two of them are thus closely dependent on the third; and the opinion of the majority of the best critics has, of late years, more and more converged toward the conviction that our canonical second Gospel (the so-called "Mark's" Gospel) is that which most closely represents the primitive groundwork of the three.# That I take to be

* "Popular Science Monthly" for May, 1889, p. 68. † Ibid., p. 69.

‡ I suppose this is what Dr. Wace is thinking about when he says that I allege that there "is no visible escape" from the supposition of an "Ur-Marcus" (p. 82). That a "theologian of repute" should confound an indisputable fact with one of the modes of explaining that fact, is not so singular as those who are unaccustomed to the ways of theologians might imagine.

Any examiner whose duty it has been to examine into a case of "copying" will be particularly well prepared to appreciate the force of the case stated in that most excellent little book, "The Common Tradition of the Synoptic Gospels," by Dr. Abbott and Mr. Rushbrooke (Macmillan, 1884). To those who have not passed through such painful experiences I may recommend the brief discussion of the genuineness of the "Casket Letters" in my friend Mr. Skelton's interesting book, "Maitland of Lethington." The second edition of Holtzmann's "Lehrbuch," published in 1886, gives a remarkably fair and full account of

one of the most valid results of New Testament criticism, of immeasurably greater importance than the discussion about dates and authorship.

But if, as I believe to be the case, beyond any rational doubt or dispute, the second Gospel is the nearest extant representative of the oldest tradition, whether written or oral, how comes it that it contains neither the "Sermon on the Mount" nor the "Lord's Prayer," those typical embodiments, according to Dr. Wace, of the "essential belief and cardinal teaching" of Jesus? Not only does "Mark's" Gospel fail to contain the "Sermon on the Mount," or anything but a very few of the sayings contained in that collection; but, at the point of the history of Jesus where the "Sermon" occurs in "Matthew," there is in "Mark" an apparently unbroken narrative, from the calling of James and John to the healing of Simon's wife's mother. Thus the oldest tradition not only ignores the "Sermon on the Mount," but, by implication, raises a probability against its being delivered when and where the later "Matthew" inserts it in his compilation.

And still more weighty is the fact that the third Gospel, the author of which tells us that he wrote after "many" others had "taken in hand" the same enterprise; who should therefore have known the first Gospel (if it existed), and was bound to pay to it the deference due to the work of an apostolic eye-witness (if he had any reason for thinking it was so)—this writer, who exhibits far more literary competence than the other two, ignores any "Sermon on the Mount," such as that reported by "Matthew," just as much as the oldest authority does. Yet "Luke" has a great many passages identical, or parallel, with those in "Matthew's" "Sermon on the Mount," which are, for the most part, scattered about in a totally different connection.

Interposed, however, between the nomination of the apostles and a visit to Capernaum; occupying, therefore, a place which answers to that of the "Sermon on the Mount" in the first Gospel, there is, in the third Gospel, a discourse which is as closely similar to the "Sermon on the Mount" in some particulars, as it is widely unlike it in others.

This discourse is said to have been delivered in a "plain" or "level place" (Luke vi, 17), and by way of distinction we may call it the "Sermon on the Plain."

I see no reason to doubt that the two evangelists are dealing, to a considerable extent, with the same traditional material; and a comparison of the two "sermons" suggests very strongly that

the present results of criticism. At page 366 he writes that the present burning question is whether the "relatively primitive narration and the root of the other synoptic texts is contained in Matthew or in Mark. It is only on this point that properly informed (*sachkundige*) critics differ," and he decides in favor of Mark.

"Luke's" version is the earlier. The correspondences between the two forbid the notion that they are independent. They both begin with a series of blessings, some of which are almost verbally identical. In the middle of each (Luke vi, 27–38, Matthew v, 43–48) there is a striking exposition of the ethical spirit of the command given in Leviticus xix, 18. And each ends with a passage containing the declaration that a tree is to be known by its fruit, and the parable of the house built on the sand. But while there are only twenty-nine verses in the "Sermon on the Plain," there are one hundred and seven in the "Sermon on the Mount"; the excess in length of the latter being chiefly due to the long interpolations, one of thirty verses before, and one of thirty-four verses after, the middlemost parallelism with Luke. Under these circumstances, it is quite impossible to admit that there is more probability that "Matthew's" version of the sermon is historically accurate than there is that Luke's version is so; and they can not both be accurate.

"Luke" either knew the collection of loosely connected and aphoristic utterances which appear under the name of the "Sermon on the Mount" in "Matthew," or he did not. If he did not, he must have been ignorant of the existence of such a document as our canonical "Matthew," a fact which does not make for the genuineness or the authority of that book. If he did, he has shown that he does not care for its authority on a matter of fact of no small importance; and that does not permit us to conceive that he believed the first Gospel to be the work of an authority to whom he ought to defer, let alone that of an apostolic eye-witness.

The tradition of the Church about the second Gospel, which I believe to be quite worthless, but which is all the evidence there is for "Mark's" authorship, would have us believe that "Mark" was little more than the mouth-piece of the apostle Peter. Consequently, we are to suppose that Peter either did not know, or did not care very much for, that account of the "essential belief and cardinal teaching" of Jesus which is contained in the Sermon on the Mount; and, certainly, he could not have shared Dr. Wace's view of its importance.*

I thought that all fairly attentive and intelligent students of the Gospels, to say nothing of theologians of reputation, knew these things. But how can any one who does know them have the conscience to ask whether there is "any reasonable doubt"

* Holtzmann ("Die synoptischen Evangelien," 1863, p. 75), following Ewald, argues that the "Source A" (= the threefold tradition, more or less) contained something that answered to the "Sermon on the Plain" immediately after the words of our present Mark, "And he cometh into a house" (iii, 19). But what conceivable motive could "Mark" have for omitting it? Holtzmann has no doubt, however, that the "Sermon on the Mount" is a compilation, or, as he calls it in his recently published "Lehrbuch" (p. 372), "an artificial mosaic work."

that the Sermon on the Mount was preached by Jesus of Nazareth? If conjecture is permissible, where nothing else is possible, the most probable conjecture seems to be that "Matthew," having a *cento* of sayings attributed—rightly or wrongly it is impossible to say—to Jesus, among his materials, thought they were, or might be, records of a continuous discourse, and put them in at the place he thought likeliest. Ancient historians of the highest character saw no harm in composing long speeches which never were spoken, and putting them into the mouths of statesmen and warriors; and I presume that whoever is represented by "Matthew" would have been grievously astonished to find that any one objected to his following the example of the best models accessible to him.

So with the "Lord's Prayer." Absent in our representative of the oldest tradition, it appears in both "Matthew" and "Luke." There is reason to believe that every pious Jew, at the commencement of our era, prayed three times a day, according to a formula which is embodied in the present *Schmone-Esre** of the Jewish prayer-book. Jesus, who was assuredly, in all respects, a pious Jew, whatever else he may have been, doubtless did the same. Whether he modified the current formula, or whether the so-called "Lord's Prayer" is the prayer substituted for the *Schmone-Esre* in the congregations of the Gentiles, who knew nothing of the Jewish practice, is a question which can hardly be answered.

In a subsequent passage of Dr. Wace's article† he adds to the list of the verities which he imagines to be unassailable, "The story of the Passion." I am not quite sure what he means by this—I am not aware that any one (with the exception of certain ancient heretics) has propounded doubts as to the reality of the crucifixion; and certainly I have no inclination to argue about the precise accuracy of every detail of that pathetic story of suffering and wrong. But, if Dr. Wace means, as I suppose he does, that that which, according to the orthodox view, happened after the crucifixion, and which is, in a dogmatic sense, the most important part of the story, is founded on solid historical proofs, I must beg leave to express a diametrically opposite conviction.

What do we find when the accounts of the events in question, contained in the three synoptic Gospels, are compared together? In the oldest, there is a simple, straightforward statement which, for anything that I have to urge to the contrary, may be exactly true. In the other two, there is, round this possible and probable nucleus, a mass of accretions of the most questionable character.

The cruelty of death by crucifixion depended very much upon its lingering character. If there were a support for the weight of the body, as not unfrequently was the case, the pain during the

* See Schürer, "Geschichte des jüdischen Volkes," Zweiter Theil, p. 384.

† "Popular Science Monthly" for May, 1889, p. 69.

first hours of the infliction was not, necessarily, extreme; nor need any serious physical symptoms at once arise from the wounds made by the nails in the hands and feet, supposing they were nailed, which was not invariably the case. When exhaustion set in, and hunger, thirst, and nervous irritation had done their work, the agony of the sufferer must have been terrible; and the more terrible that, in the absence of any effectual disturbance of the machinery of physical life, it might be prolonged for many hours, or even days. Temperate, strong men, such as the ordinary Galilean peasants were, might live for several days on the cross. It is necessary to bear these facts in mind when we read the account contained in the fifteenth chapter of the second Gospel.

Jesus was crucified at the third hour (xv, 25), and the narrative seems to imply that he died immediately after the ninth hour (*v.* 34). In this case, he would have been crucified only six hours; and the time spent on the cross can not have been much longer, because Joseph of Arimathæa must have gone to Pilate, made his preparations, and deposited the body in the rock-cut tomb before sunset, which, at that time of the year, was about the twelfth hour. That any one should die after only six hours' crucifixion could not have been at all in accordance with Pilate's large experience in the effects of that method of punishment. It, therefore, quite agrees with what might be expected if Pilate "marveled if he were already dead," and required to be satisfied on this point by the testimony of the Roman officer who was in command of the execution party. Those who have paid attention to the extraordinarily difficult question, What are the indisputable signs of death?—will be able to estimate the value of the opinion of a rough soldier on such a subject; even if his report to the procurator were in no wise affected by the fact that the friend of Jesus, who anxiously awaited his answer, was a man of influence and of wealth.

The inanimate body, wrapped in linen, was deposited in a spacious,* cool, rock chamber, the entrance of which was closed, not by a well-fitting door, but by a stone rolled against the opening, which would of course allow free passage of air. A little more than thirty-six hours afterward (Friday 6 P. M., to Sunday 6 A. M., or a little after) three women visit the tomb and find it empty. And they are told by a young man "arrayed in a white robe" that Jesus is gone to his native country of Galilee, and that the disciples and Peter will find him there.

Thus it stands, plainly recorded, in the oldest tradition that, for any evidence to the contrary, the sepulchre may have been vacated at any time during the Friday or Saturday nights. If it

* Spacious, because a young man could sit in it "on the right side" (xv, 5), and therefore with plenty of room to spare.

is said that no Jew would have violated the Sabbath by taking the former course, it is to be recollected that Joseph of Arimathæa might well be familiar with that wise and liberal interpretation of the fourth commandment, which permitted works of mercy to men—nay even the drawing of an ox or an ass out of a pit—on the Sabbath. At any rate, the Saturday night was free to the most scrupulous observers of the law.

These are the facts of the case as stated by the oldest extant narrative of them. I do not see why any one should have a word to say against the inherent probability of that narrative; and, for my part, I am quite ready to accept it as an historical fact, that so much and no more is positively known of the end of Jesus of Nazareth. On what grounds can a reasonable man be asked to believe any more? So far as the narrative in the first Gospel, on the one hand, and those in the third Gospel and the Acts, on the other go beyond what is stated in the second Gospel, they are hopelessly discrepant with one another. And this is the more significant because the pregnant phrase "some doubted," in the first Gospel, is ignored in the third.

But it is said that we have the witness Paul speaking to us directly in the Epistles. There is little doubt that we have, and a very singular witness he is. According to his own showing, Paul, in the vigor of his manhood, with every means of becoming acquainted, at first hand, with the evidence of eye-witnesses, not merely refused to credit them, but "persecuted the church of God and made havoc of it." The reasoning of Stephen fell dead upon the acute intellect of this zealot for the traditions of his fathers: his eyes were blind to the ecstatic illumination of the martyr's countenance "as it had been the face of an angel"; and when, at the words "Behold, I see the heavens opened and the Son of man standing on the right hand of God," the murderous mob rushed upon and stoned the rapt disciple of Jesus, Paul ostentatiously made himself their official accomplice.

Yet this strange man, because he has a vision one day, at once, and with equally headlong zeal, flies to the opposite pole of opinion. And he is most careful to tell us that he abstained from any re-examination of the facts.

> Immediately I conferred not with flesh and blood; neither went I up to Jerusalem to them which were apostles before me; but I went away into Arabia. (Galatians i, 16, 17.)

I do not presume to quarrel with Paul's procedure. If it satisfied him, that was his affair; and, if it satisfies any one else, I am not called upon to dispute the right of that person to be satisfied. But I certainly have the right to say that it would not satisfy me, in like case; that I should be very much ashamed to pretend that it could, or ought to, satisfy me; and that I can entertain but a

very low estimate of the value of the evidence of people who are to be satisfied in this fashion, when questions of objective fact, in which their faith is interested, are concerned. So that, when I am called upon to believe a great deal more than the oldest Gospel tells me about the final events of the history of Jesus on the authority of Paul (1 Corinthians xv, 5–8), I must pause. Did he think it, at any subsequent time, worth while "to confer with flesh and blood," or, in modern phrase, to re-examine the facts for himself? or was he ready to accept anything that fitted in with his preconceived ideas? Does he mean, when he speaks of all the appearances of Jesus after the crucifixion as if they were of the same kind, that they were all visions, like the manifestation to himself? And, finally, how is this account to be reconciled with those in the first and the third Gospels—which, as we have seen, disagree with one another?

Until these questions are satisfactorily answered, I am afraid that, so far as I am concerned, Paul's testimony can not be seriously regarded, except as it may afford evidence of the state of traditional opinion at the time at which he wrote, say between 55 and 60 A. D.; that is, more than twenty years after the event; a period much more than sufficient for the development of any amount of mythology about matters of which nothing was really known. A few years later, among the contemporaries and neighbors of the Jews, and, if the most probable interpretation of the Apocalypse can be trusted, among the followers of Jesus also, it was fully believed, in spite of all evidence to the contrary, that the Emperor Nero was not really dead, but that he was hidden away somewhere in the East, and would speedily come again at the head of a great army, to be revenged upon his enemies.

Thus, I conceive that I have shown cause for the opinion that Dr. Wace's challenge touching the Sermon on the Mount, the Lord's Prayer, and the Passion, was more valorous than discreet. After all this discussion, I am still at the agnostic point. Tell me, first, what Jesus can be proved to have been, said, and done, and I will tell you whether I believe him, or in him,* or not! As Dr. Wace admits that I have dissipated his lingering shade of unbelief about the bedevilment of the Gadarene pigs, he might have done something to help mine. Instead of that, he manifests a total want of conception of the nature of the obstacles which impede the conversion of his "infidels."

The truth I believe to be, that the difficulties in the way of

* I am very sorry for the interpolated "in," because citation ought to be accurate in small things as in great. But what difference it makes whether one "believes Jesus" or "believes in Jesus" much thought has not enabled me to discover. If you "believe him" you must believe him to be what he professed to be—that is, "believe in him"; and if you "believe in him" you must necessarily "believe him."

arriving at a sure conclusion as to these matters, from the Sermon on the Mount, the Lord's Prayer, or any other data offered by the synoptic Gospels (and *a fortiori* from the fourth Gospel) are insuperable. Every one of these records is colored by the prepossessions of those among whom the primitive traditions arose and of those by whom they were collected and edited; and the difficulty of making allowance for these prepossessions is enhanced by our ignorance of the exact dates at which the documents were first put together; of the extent to which they have been subsequently worked over and interpolated; and of the historical sense, or want of sense, and the dogmatic tendencies, of their compilers and editors. Let us see if there is any other road which will take us into something better than negation.

There is a wide-spread notion that the "primitive Church," while under the guidance of the apostles and their immediate successors, was a sort of dogmatic dove-cote, pervaded by the most loving unity and doctrinal harmony. Protestants, especially, are fond of attributing to themselves the merit of being nearer "the Church of the apostles" than their neighbors; and they are the less to be excused for their strange delusion because they are great readers of the documents which prove the exact contrary. The fact is that, in the course of the first three centuries of its existence, the Church rapidly underwent a process of evolution of the most remarkable character, the final stage of which is far more different from the first than Anglicanism is from Quakerism. The key to the comprehension of the problem of the origin of that which is now called "Christianity," and its relation to Jesus of Nazareth, lies here. Nor can we arrive at any sound conclusion as to what it is probable that Jesus actually said and did without being clear on this head. By far the most important and subsequently influential steps in the evolution of Christianity took place in the course of the century, more or less, which followed upon the crucifixion. It is almost the darkest period of Church history, but, most fortunately, the beginning and the end of the period are brightly illuminated by the contemporary evidence of two writers of whose historical existence there is no doubt,* and against the genuineness of whose most important works there is no widely admitted objection. These are Justin, the philosopher and martyr, and Paul, the Apostle to the Gentiles. I shall call upon these witnesses only to testify to the condition of opinion among those who called themselves disciples of Jesus in their time.

Justin, in his dialogue with Trypho the Jew, which was written somewhere about the middle of the second century, enumerates

* True for Justin; but there is a school of theological critics, who more or less question the historical reality of Paul and the genuineness of even the four cardinal epistles.

certain categories of persons who, in his opinion, will, or will not, be saved.* These are:

1. Orthodox Jews who refuse to believe that Jesus is the Christ. *Not saved.*

2. Jews who observe the law; believe Jesus to be the Christ; but who insist on the observance of the law by Gentile converts. *Not saved.*

3. Jews who observe the law; believe Jesus to be the Christ, and hold that Gentile converts need not observe the law. *Saved* (in Justin's opinion; but some of his fellow-Christians think the contrary).

4. Gentile converts to the belief in Jesus as the Christ, who observe the law. *Saved* (possibly).

5. Gentile believers in Jesus as the Christ, who do not observe the law themselves (except so far as the refusal of idol sacrifices), but do not consider those who do observe it heretics. *Saved* (this is Justin's own view).

6. Gentile believers who do not observe the law except in refusing idol sacrifices, and hold those who do observe it to be heretics. *Saved.*

7. Gentiles who believe Jesus to be the Christ and call themselves Christians. but who eat meats sacrificed to idols. *Not saved.*

8. Gentiles who disbelieve in Jesus as the Christ. *Not saved.*

Justin does not consider Christians who believe in the natural birth of Jesus, of whom he implies that there is a respectable minority, to be heretics, though he himself strongly holds the preternatural birth of Jesus and his pre-existence as the "Logos" or "Word." He conceives the Logos to be a second God, inferior to the first, unknowable, God, with respect to whom Justin, like Philo, is a complete agnostic. The Holy Spirit is not regarded by Justin as a separate personality, and is often mixed up with the "Logos." The doctrine of the natural immortality of the soul is, for Justin, a heresy; and he is as firm a believer in the resurrection of the body as in the speedy second coming and the establishment of the millennium.

This pillar of the Church in the middle of the second century—a much-traveled native of Samaria—was certainly well acquainted with Rome, probably with Alexandria, and it is likely that he knew the state of opinion throughout the length and breadth of the Christian world as well as any man of his time. If the various categories above enumerated are arranged in a series thus—

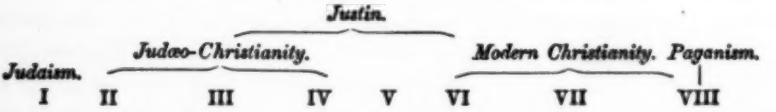
		Justin's Christianity.					
Orthodox Judaism.	*Judæo-Christianity.*					*Idolothytic Christianity.*	*Paganism.*
I	II	III	IV	V	VI	VII	VIII

* See "Dial. cum Tryphone," sections 47 and 35. It is to be understood that Justin does not arrange these categories in order as I have done.

it is obvious that they form a gradational series from orthodox Judaism, on the extreme left, to paganism, whether philosophic or popular, on the extreme right; and it will further be observed that, while Justin's conception of Christianity is very broad, he rigorously excludes two classes of persons who, in his time, called themselves Christians; namely, those who insist on circumcision and other observances of the law on the part of Gentile converts; that is to say, the strict Judæo-Christians (II), and, on the other hand, those who assert the lawfulness of eating meat offered to idols—whether they are gnostics or not (VII). These last I have called "idolothytic" Christians, because I can not devise a better name, not because it is strictly defensible etymologically.

At the present moment I do not suppose there is an English missionary in any heathen land who would trouble himself whether the materials of his dinner had been previously offered to idols or not. On the other hand, I suppose there is no Protestant sect within the pale of orthodoxy, to say nothing of the Roman and Greek Churches, which would hesitate to declare the practice of circumcision and the observance of the Jewish Sabbath and dietary rules, shockingly heretical.

Modern Christianity has, in fact, not only shifted far to the right of Justin's position, but it is of much narrower compass.



For, though it includes VII, and even, in saint and relic worship, cuts a "monstrous cantle" out of paganism, it excludes, not only all Judæo-Christians, but all who doubt that such are heretics. Ever since the thirteenth century, the Inquisition would have cheerfully burned, and in Spain did abundantly burn, all persons who came under the categories II, III, IV, V. And the wolf would play the same havoc now if it could only get its blood-stained jaws free from the muzzle imposed by the secular arm.

Further, there is not a Protestant body except the Unitarian, which would not declare Justin himself a heretic, on account of his doctrine of the inferior godship of the Logos; while I am very much afraid that, in strict logic, Dr. Wace would be under the necessity, so painful to him, of calling him an "infidel," on the same and on other grounds.

Now let us turn to our other authority. If there is any result of critical investigations of the sources of Christianity which is certain,* it is that Paul of Tarsus wrote the Epistle to the Gala-

* I guard myself against being supposed to affirm that even the four cardinal epistles of Paul may not have been seriously tampered with. See no e on page 176.

tians somewhere between the years 55 and 60 A. D., that is to say, roughly, twenty, or five-and-twenty, years after the crucifixion. If this is so, the Epistle to the Galatians is one of the oldest, if not the very oldest, of extant documentary evidences of the state of the primitive Church. And, be it observed, if it is Paul's writing, it unquestionably furnishes us with the evidence of a participator in the transactions narrated. With the exception of two or three of the other Pauline epistles, there is not one solitary book in the New Testament of the authorship and authority of which we have such good evidence.

And what is the state of things we find disclosed? A bitter quarrel, in his account of which Paul by no means minces matters or hesitates to hurl defiant sarcasms against those who were "reputed to be pillars": James, "the brother of the Lord," Peter, the rock on whom Jesus is said to have built his Church, and John, "the beloved disciple." And no deference toward "the rock" withholds Paul from charging Peter to his face with "dissimulation."

The subject of the hot dispute was simply this: Were Gentile converts bound to obey the law or not? Paul answered in the negative; and, acting upon his opinion, had created at Antioch (and elsewhere) a specifically "Christian" community, the sole qualifications for admission into which were the confession of the belief that Jesus was the Messiah, and baptism upon that confession. In the epistle in question, Paul puts this—his "gospel," as he calls it—in its most extreme form. Not only does he deny the necessity of conformity with the law, but he declares such conformity to have a negative value. "Behold, I, Paul, say unto you, that if ye receive circumcision, Christ will profit you nothing" (Galatians v, 2). He calls the legal observances "beggarly rudiments," and anathematizes every one who preaches to the Galatians any other gospel than his own—that is to say, by direct consequence, he anathematizes the Jerusalem Nazarenes whose zeal for the law is testified by James in a passage of the Acts cited further on. In the first Epistle to the Corinthians, dealing with the question of eating meat offered to idols, it is clear that Paul himself thinks it a matter of indifference; but he advises that it should not be done, for the sake of the weaker brethren. On the other hand, the Nazarenes of Jerusalem most strenuously opposed Paul's "gospel," insisting on every convert becoming a regular Jewish proselyte, and consequently on his observance of the whole law; and this party was led by James and Peter and John (Galatians ii, 9). Paul does not suggest that the question of principle was settled by the discussion referred to in Galatians. All he says is that it ended in the practical agreement that he and Barnabas should do as they had been doing in respect of the Gentiles;

while James and Peter and John should deal in their own fashion with Jewish converts. Afterward he complains bitterly of Peter, because, when on a visit to Antioch, he at first inclined to Paul's view, and ate with the Gentile converts; but when "certain came from James," "drew back, and separated himself, fearing them that were of the circumcision. And the rest of the Jews dissembled likewise with him; insomuch that even Barnabas was carried away with their dissimulation" (Galatians ii, 12, 13).

There is but one conclusion to be drawn from Paul's account of this famous dispute, the settlement of which determined the fortunes of the nascent religion. It is that the disciples at Jerusalem, headed by "James, the Lord's brother," and by the leading apostles, Peter and John, were strict Jews, who objected to admit any converts to their body, unless these, either by birth or by becoming proselytes, were also strict Jews. In fact, the sole difference between James and Peter and John, with the body of disciples whom they led, and the Jews by whom they were surrounded, and with whom they for many years shared the religious observances of the Temple, was that they believed that the Messiah, whom the leaders of the nation yet looked for, had already come in the person of Jesus of Nazareth.

The Acts of the Apostles is hardly a very trustworthy history; it is certainly of later date than the Pauline epistles, supposing them to be genuine. And the writer's version of the conference of which Paul gives so graphic a description, if that is correct, is unmistakably colored with all the art of a reconciler, anxious to cover up a scandal. But it is none the less instructive on this account. The judgment of the "council" delivered by James is that the Gentile converts shall merely "abstain from things sacrificed to idols, and from blood and from things strangled, and from fornication." But notwithstanding the accommodation in which the writer of the Acts would have us believe, the Jerusalem church held to its endeavor to retain the observance of the law. Long after the conference, some time after the writing of the Epistles to the Galatians and Corinthians, and immediately after the dispatch of that to the Romans, Paul makes his last visit to Jerusalem, and presents himself to James and all the elders. And this is what the Acts tells us of the interview:

> And they said unto him, Thou seest, brother, how many thousands (or myriads) there are among the Jews of them which have believed; and they are all zealous for the law: and they have been informed concerning thee, that thou teachest all the Jews which are among the Gentiles to forsake Moses, telling them not to circumcise their children, neither to walk after the customs (Acts xxi, 20, 21).

They therefore request that he should perform a certain public religious act in the Temple, in order that

all shall know that there is no truth in the things whereof they have been informed concerning thee; but that thou thyself walkest orderly, keeping the law (ibid., 24).

How far Paul could do what he is here requested to do, and which the writer of the Acts goes on to say he did, with a clear conscience, if he wrote the epistles to the Galatians and Corinthians, I may leave any candid reader of those epistles to decide. The point to which I wish to direct attention is the declaration that the Jerusalem church, led by the brother of Jesus and by his personal disciples and friends, twenty years and more after his death, consisted of strict and zealous Jews.

Tertullus, the orator, caring very little about the internal dissensions of the followers of Jesus, speaks of Paul as a "ringleader of the sect of the Nazarenes" (Acts xxiv, 5), which must have affected James much in the same way as it would have moved the Archbishop of Canterbury, in George Fox's day, to hear the latter called a "ringleader of the sect of Anglicans." In fact, "Nazarene" was, as is well known, the distinctive appellation applied to Jesus; his immediate followers were known as Nazarenes, while the congregation of the disciples, and, later, of converts at Jerusalem—the Jerusalem church—was emphatically the "sect of the Nazarenes," no more in itself to be regarded as anything outside Judaism than the sect of the Sadducees or of the Essenes.* In fact, the tenets of both the Sadducees and the Essenes diverged much more widely from the Pharisaic standard of orthodoxy than Nazarenism did.

Let us consider the position of affairs now (A. D. 50–60) in relation to that which obtained in Justin's time, a century later. It is plain that the Nazarenes—presided over by James "the brother of the Lord," and comprising within their body all the twelve apostles—belonged to Justin's second category of "Jews who observe the law, believe Jesus to be the Christ, but who insist on the observance of the law by Gentile converts," up till the time at which the controversy reported by Paul arose. They then, according to Paul, simply allowed him to form his congregation of non-legal Gentile converts at Antioch and elsewhere; and it would seem that it was to these converts, who would come under Justin's fifth category, that the title of "Christian" was first applied. If any of these Christians had acted upon the more than half-permission given by Paul, and had eaten meats offered to idols, they would have belonged to Justin's seventh category.

Hence, it appears that, if Justin's opinion, which was doubtless that of the church generally in the middle of the second century, was correct, James and Peter and John and their followers could

* All this was quite clearly pointed out by Ritschl nearly forty years ago. See "Die Entstehung der alt-katholischen Kirche" (1850), p. 108.

not be saved; neither could Paul, if he carried into practice his views as to the indifference of eating meats offered to idols. Or, to put the matter another way, the center of gravity of orthodoxy, which is at the extreme right of the series in the nineteenth century, was at the extreme left, just before the middle of the first century, when the "sect of the Nazarenes" constituted the whole church founded by Jesus and the apostles; while, in the time of Justin, it lay midway between the two. It is therefore a profound mistake to imagine that the Judæo-Christians (Nazarenes and Ebionites) of later times were heretical outgrowths from a primitive, universalist "Christianity." On the contrary, the universalist "Christianity" is an outgrowth from the primitive, purely Jewish, Nazarenism; which, gradually eliminating all the ceremonial and dietary parts of the Jewish law, has thrust aside its parent, and all the intermediate stages of its development, into the position of damnable heresies.

Such being the case, we are in a position to form a safe judgment of the limits within which the teaching of Jesus of Nazareth must have been confined. Ecclesiastical authority would have us believe that the words which are given at the end of the first Gospel, "Go ye, therefore, and make disciples of all the nations, baptizing them in the name of the Father and of the Son and of the Holy Ghost," are part of the last commands of Jesus, issued at the moment of his parting with the eleven. If so, Peter and John must have heard these words; they are too plain to be misunderstood; and the occasion is too solemn for them to be ever forgotten. Yet the "Acts" tells us that Peter needed a vision to enable him so much as to baptize Cornelius; and Paul, in the Galatians, knows nothing of words which would have completely borne him out as against those who, though they heard, must be supposed to have either forgotten or ignored them. On the other hand, Peter and John, who are supposed to have heard the "Sermon on the Mount," know nothing of the saying that Jesus had not come to destroy the law, but that every jot and tittle of the law must be fulfilled, which surely would have been pretty good evidence for their view of the question.

We are sometimes told that the personal friends and daily companions of Jesus remained zealous Jews and opposed Paul's innovations, because they were hard of heart and dull of comprehension. This hypothesis is hardly in accordance with the concomitant faith of those who adopt it, in the miraculous insight and superhuman sagacity of their Master; nor do I see any way of getting it to harmonize with the other orthodox postulate; namely, that Matthew was the author of the first Gospel and John of the fourth. If that is so, then, most assuredly, Matthew was no dullard; and as for the fourth Gospel—a theosophic romance of the

first order—it could have been written by none but a man of remarkable literary capacity, who had drunk deep of Alexandrian philosophy. Moreover, the doctrine of the writer of the fourth Gospel is more remote from that of the "sect of the Nazarenes" than is that of Paul himself. I am quite aware that orthodox critics have been capable of maintaining that John, the Nazarene, who was probably well past fifty years of age when he is supposed to have written the most thoroughly Judaizing book in the New Testament—the Apocalypse—in the roughest of Greek, underwent an astounding metamorphosis of both doctrine and style by the time he reached the ripe age of ninety or so, and provided the world with a history in which the acutest critic can not make out where the speeches of Jesus end and the text of the narrative begins; while that narrative is utterly irreconcilable in regard to matters of fact with that of his fellow-apostle, Matthew.

The end of the whole matter is this: The "sect of the Nazarenes," the brother and the immediate followers of Jesus, commissioned by him as apostles, and those who were taught by them up to the year 50 A. D., were not "Christians" in the sense in which that term has been understood ever since its asserted origin at Antioch, but Jews—strict orthodox Jews—whose belief in the Messiahship of Jesus never led to their exclusion from the Temple services, nor would have shut them out from the wide embrace of Judaism.* The open proclamation of their special view about the Messiah was doubtless offensive to the Pharisees, just as rampant Low Churchism is offensive to bigoted High Churchism in our own country; or as any kind of dissent is offensive to fervid religionists of all creeds. To the Sadducees, no doubt, the political danger of any Messianic movement was serious, and they would have been glad to put down Nazarenism, lest it should end in useless rebellion against their Roman masters, like that other Galilean movement headed by Judas, a generation earlier. Galilee was always a hot-bed of seditious enthusiasm against the rule of Rome; and high priest and procurator alike had need to keep a sharp eye upon natives of that district. On the whole, however, the Nazarenes were but little troubled for the first twenty years of their existence; and the undying hatred of the Jews against those later converts whom they regarded as apostates and fautors of a sham Judaism was awakened by Paul. From their point of view, he was a mere renegade Jew, opposed alike to orthodox Judaism and to orthodox Nazarenism, and whose teachings threatened Judaism

* "If every one was baptized as soon as he acknowledged Jesus to be the Messiah, the first Christians can have been aware of no other essential differences from the Jews."—Zeller, "Vorträge" (1865), p. 216.

with destruction. And, from their point of view, they were quite right. In the course of a century, Pauline influences had a large share in driving primitive Nazarenism from being the very heart of the new faith into the position of scouted error; and the spirit of Paul's doctrine continued its work of driving Christianity further and further away from Judaism, until "meats offered to idols" might be eaten without scruple, while the Nazarene methods of observing even the Sabbath or the Passover were branded with the mark of Judaizing heresy.

But if the primitive Nazarenes of whom the Acts speaks were orthodox Jews, what sort of probability can there be that Jesus was anything else? How can he have founded the universal religion which was not heard of till twenty years after his death?* That Jesus possessed in a rare degree the gift of attaching men to his person and to his fortunes; that he was the author of many a striking saying, and the advocate of equity, of love, and of humility; that he may have disregarded the subtleties of the bigots for legal observance, and appealed rather to those noble conceptions of religion which constituted the pith and kernel of the teaching of the great prophets of his nation seven hundred years earlier; and that, in the last scenes of his career, he may have embodied the ideal sufferer of Isaiah—may be, as I think it is, extremely probable. But all this involves not a step beyond the borders of orthodox Judaism. Again, who is to say whether Jesus proclaimed himself the veritable Messiah, expected by his nation since the appearance of the pseudo-prophetic work of Daniel, a century and a half before his time; or whether the enthusiasm of his followers gradually forced him to assume that position?

But one thing is quite certain: if that belief in the speedy second coming of the Messiah which was shared by all parties in the primitive church, whether Nazarene or Pauline; which Jesus is made to prophesy, over and over again, in the synoptic Gospels; and which dominated the life of Christians during the first century after the crucifixion—if he believed and taught that, then assuredly he was under an illusion, and he is responsible for that which the mere effluxion of time has demonstrated to be a prodigious error.

When I ventured to doubt "whether any Protestant theologian who has a reputation to lose will say that he believes the Gadarene story," it appears that I reckoned without Dr. Wace, who, referring to this passage in my paper, says:

* Dr. Harnack, in the lately published second edition of his "Dogmengeschichte," says (p. 39), "Jesus Christ brought forward no new doctrine"; and again (p. 65), "It is not difficult to set against every portion of the utterances of Jesus an observation which deprives him of originality." See also Zusatz 4, on the same page.

He will judge whether I fall under his description; but I repeat that I believe it, and that he has removed the only objection to my believing it.*

Far be it from me to set myself up as a judge of any such delicate question as that put before me; but I think I may venture to express the conviction that, in the matter of courage, Dr. Wace has raised for himself a monument *ære perennius*. For, really, in my poor judgment, a certain splendid intrepidity, such as one admires in the leader of a forlorn hope, is manifested by Dr. Wace when he solemnly affirms that he believes the Gadarene story on the evidence offered. I feel less complimented perhaps than I ought to do, when I am told that I have been an accomplice in extinguishing in Dr. Wace's mind the last glimmer of doubt which common sense may have suggested. In fact, I must disclaim all responsibility for the use to which the information I supplied has been put. I formally decline to admit that the expression of my ignorance whether devils, in the existence of which I do not believe, if they did exist, might or might not be made to go out of men into pigs, can, as a matter of logic, have been of any use whatever to a person who already believed in devils and in the historical accuracy of the Gospels.

Of the Gadarene story, Dr. Wace, with all solemnity and twice over, affirms that he "believes it." I am sorry to trouble him further, but what does he mean by "it"? Because there are two stories, one in "Mark" and "Luke," and the other in "Matthew." In the former, which I quoted in my previous paper, there is one possessed man; in the latter there are two. The story is told fully, with the vigorous, homely diction and the picturesque details of a piece of folk-lore, in the second Gospel. The immediately antecedent event is the storm on the Lake of Gennesareth. The immediately consequent events are the message from the ruler of the synagogue and the healing of the woman with an issue of blood. In the third Gospel, the order of events is exactly the same, and there is an extremely close general and verbal correspondence between the narratives of the miracle. Both agree in stating that there was only one possessed man, and that he was the residence of many devils, whose name was "Legion."

In the first Gospel, the event which immediately precedes the Gadarene affair is, as before, the storm; the message from the ruler and the healing of the issue are separated from it by the accounts of the healing of a paralytic, of the calling of Matthew, and of a discussion with some Pharisees. Again, while the second Gospel speaks of the country of the "Gerasenes" as the locality of the event, the third Gospel has "Gerasenes," "Gergesenes," and "Gadarenes" in different ancient MSS.; while the first has "Gadarenes."

* "Popular Science Monthly" for May, 1889, p. 76.

The really important points to be noticed, however, in the narrative of the first Gospel, are these—that there are two possessed men instead of one; and that while the story is abbreviated by omissions, what there is of it is often verbally identical with the corresponding passages in the other two Gospels. The most unabashed of reconcilers can not well say that one man is the same as two, or two as one; and, though the suggestion really has been made, that two different miracles, agreeing in all essential particulars, except the number of the possessed, were effected immediately after the storm on the lake, I should be sorry to accuse any one of seriously adopting it. Nor will it be pretended that the allegory refuge is accessible in this particular case.

So, when Dr. Wace says that he believes in the synoptic evangelists' account of the miraculous bedevilment of swine, I may fairly ask which of them does he believe? Does he hold by the one evangelist's story, or by that of the two evangelists? And having made his election, what reasons has he to give for his choice? If it is suggested that the witness of two is to be taken against that of one, not only is the testimony dealt with in that common-sense fashion against which theologians of his school protest so warmly; not only is all question of inspiration at an end, but the further inquiry arises, after all, is it the testimony of two against one? Are the authors of the versions in the second and the third Gospels really independent witnesses? In order to answer this question, it is only needful to place the English versions of the two side by side, and compare them carefully. It will then be seen that the coincidences between them, not merely in substance, but in arrangement, and in the use of identical words in the same order, are such, that only two alternatives are conceivable: either one evangelist freely copied from the other, or both based themselves upon a common source, which may either have been a written document, or a definite oral tradition learned by heart. Assuredly, these two testimonies are not those of independent witnesses. Further, when the narrative in the first Gospel is compared with that in the other two, the same fact comes out.

Supposing, then, that Dr. Wace is right in his assumption that Matthew, Mark, and Luke wrote the works which we find attributed to them by tradition, what is the value of their agreement, even that something more or less like this particular miracle occurred, since it is demonstrable, either that all depend on some antecedent statement, of the authorship of which nothing is known, or that two are dependent upon the third?

Dr. Wace says he believes the Gadarene story; whichever version of it he accepts, therefore, he believes that Jesus said what he is stated in all the versions to have said, and thereby virtually

declared that the theory of the nature of the spiritual world involved in the story is true. Now I hold that this theory is false, that it is a monstrous and mischievous fiction; and I unhesitatingly express my disbelief in any assertion that it is true, by whomsoever made. So that, if Dr. Wace is right in his belief, he is also quite right in classing me among the people he calls "infidels"; and although I can not fulfill the eccentric expectation of the Bishop of Peterborough, that I shall glory in a title which, from my point of view, it would be simply silly to adopt, I certainly shall rejoice not to be reckoned among the bishop's "us Christians" so long as the profession of belief in such stories as the Gadarene pig affair, on the strength of a tradition of unknown origin, of which two discrepant reports, also of unknown origin, alone remain, forms any part of the Christian faith. And, although I have, more than once, repudiated the gift of prophecy, yet I think I may venture to express the anticipation, that if "Christians" generally are going to follow the line taken by the Bishop of Peterborough and Dr. Wace, it will not be long before all men of common sense qualify for a place among the "infidels." —*Nineteenth Century.*

FUNGI.

I.—TOADSTOOLS AND MUSHROOMS.*

By T. H. McBRIDE,
PROFESSOR OF BOTANY IN THE UNIVERSITY OF IOWA.

THE fungi as a class may hardly be called popular. For various reasons they are, so to speak, under a cloud. They are little known, and so in lieu of better information the legend "poison" seems to run for all the finer and more showy species. If not held absolutely poisonous, most are at least considered useless and are nameless. Literature, the all-embracing, which concerns itself freely with other forms of animate nature, draws a line at the fungi; and Browning evinces great boldness when he ventures to touch with the wand of his poesy "the freaked, fawn-colored, flaky crew" that rises in November hours.

Worse than all this, thanks to the imperfect knowledge of days not long gone by, the very word *fungus* is uncanny, and to most minds of vague, uncertain application, suggestive of things unpleasant, not to say direful. For what, forsooth, is a fungus? A wily invader which, having by some unguarded entrance gained access, may do all sorts of mischief; may fill our cellar, for instance, and turn us out of house and home, as one is reputed to have filled the

* Illustrations from drawings by M. F. Linder and the author.

cellar of the wine merchant, barring the door from within and threatening summary eviction and what not! Is it not a fearful parasite which, having found lodging in the tissues of its unwilling host, swells to proportions vast, a hidden tumor, sending its human victim all too soon forth from his tenement of clay?

Even when not thus associated with the destruction of nobler forms, fungi are nevertheless held *suspect*. At best and largest they are odd, peculiar, hiding in out-of-the-way places, far from "the warm precincts of the cheerful day"; "off color," as men say, and owing little or no allegiance to our sovereign sun; pale, ghastly things whose homes are with the dead.

It remained for modern Science to dignify the world; nothing shall be stranger to her touch benign. Even the fungi come into prominence as they come into light. Odd as they may appear and mysterious too, they, like some odd and peculiar people, do greatly improve upon acquaintance. Certainly no one can look in upon a basket of *Boleti* fresh from August woods and not greatly admire their delicate tints, their yellows, purples, browns, and grays. Fungi, once for all, are plants, for the most part very simple ones too; in their larger forms more commonly useful than noxious, and positively sources of serious injury and detriment in those species only which to mankind at large are unseen, unknown, and unsuspected. To these reference will be made again; for the present let us consider such forms only as meet the eye of ordinary observation, the common denizens of forest and of field.

Assuming the vegetable nature of fungi, the most notable thing about them, as compared with all surrounding vegetation, is their color. Growing plants are green; Whitney says the words are synonymous. But whatever the colors fungi may take on, and they are often brilliantly tinted, they are never green, at any rate in the sense of possessing leaf-green. Without exception the fungi are chlorophyl-less. This, though a negative quality, is, nevertheless, a very convenient one, and withal expressive, for it defines exactly the place these plants must hold in the economy of nature. Chlorophyl, as is well known, gives to ordinary plants their special and peculiar ability, namely, the power to elaborate the most important organic products—starch, sugar, and the like. This power, accordingly, the chlorophyl-less fungi have not. They are strictly non-productive plants; all that they have they receive. Likewise bringing to the feast of life naught save appetite, they must needs lay under contribution, living or dead, the whole organic world, and are *parasites* or *saprophytes* according to their dietary habits. Such as derive their nourishment from dead organic matter are saprophytes, while those which assail living organisms, and derive food-supply direct from the living tissues of living hosts, are properly enough called parasites.

Somehow or other, through sympathy perhaps, we are more willing to pardon saprophytism than parasitism pure and simple, and Nature apparently takes the same view of the case, for the saprophytes include all the largest and finest specimens of the fungus kind. Mushrooms, toadstools, earth-stars, puff-balls, stink-horns, truffles, bracket-fungi, are nearly without exception saprophytes. Such fungi, too, as we see, have won attention and enjoy something of a popular classification. This classification science largely confirms—not wholly; and it is interesting to notice that it is just where the popular classification is weak that science fails to discover difference. Many a country wight and many an epicure as well would deem it rare fortune could he learn to distinguish invariably toadstools from mushrooms. Suppose we say that toadstools are poisonous while mushrooms are not. A toadstool, accordingly, is a poisonous mushroom, and a mushroom is an edible toadstool. The only possible means, therefore, by which the two may be distinguished is a test direct, as in the old rule which bids the inquirer eat with the assurance that, if he survive, he has eaten a mushroom; if he die, a toadstool. But some species poisonous to one person are by no means so to another; so that even the rule just quoted is unsatisfactory on the score of being inconclusive, as well as inconvenient of application. Even *Agaricus muscarius*, esteemed so very poisonous to ordinary mortals, is said to produce in the Kamtchatkan simply an increase of that pleasing stupidity which the Chinaman seeks in his opium-bowl or the American in his beer. Furthermore, Science runs her lines not as between toadstools and mushrooms, but as between specific forms. Poisonous and not poisonous, edible and inedible, are side by side in any enumeration of species. Let it be once known which are edible species, and these may thereafter be readily recognized by any one competent to discern a species—no easy matter, by the way, even to the practiced student.

Fig. 1.—Fruit of Green Mold (*Penicillium glaucum*).

So much for popular estimate and classification. Let us now briefly consider fungi from the standpoint of structure, the true basis of classification or distinction. A bit of mold placed on the stage of our microscope will enable us to make a beginning (Fig. 1). Here we have cells, of course, tubular in shape and disposed to form thread-like branches in different directions. These threads are known as *hyphæ*, and fungi generally are masses of

hyphæ modified here and there to the accomplishment of various functions. Fungi, like other organisms, have two principal things to do—viz., to accumulate energy and to expend it; to grow and to produce fruit. The hyphæ of a fungus are, therefore, in ordinary cases of two sorts—nutrient hyphæ forming the mycelium, and fruiting hyphæ which make up the fructification. In what we term puff-ball, mushroom, we have simply the fructification—the fruiting hyphæ—all compacted together, while the mycelium lies hidden beneath the surface. When, however, we pluck the mushroom from its place, the mycelium may perhaps seldom be discovered. There are for this two reasons: first, the mycelial threads are generally tenuous and delicate in the extreme, and unless crowded together escape observation; and, secondly, once the fructification or colony of mushrooms is formed, the energy of the mycelium having passed above the surface, the threads vanish. Only in special cases, or where the fructification is unusually large, and the number of hyphæ converging at a single point in consequence very great, do we find root-like structures that are at once obvious and persistent. Fugacious as the mycelium thus appears, it is really in many—perhaps most—cases much longer-lived than the fructification it creates. Months—possibly in some instances years—elapse while the subterranean hyphal threads ramifying and spreading through myriad diminutive tunnels are ingathering to some single center those resources of nutriment and energy which shall at length break forth with a suddenness and volume utterly astounding. In my neighbor's yard, not long ago, appeared a succession of giant puff-balls one after another, sometimes two or three at a time, over an area of perhaps thirty by forty feet. In size the plants ranged from the dimensions of a goose-egg to that of a half-bushel, and the amount of matter raised above the surface was little less than one hundred pounds. The largest fruit seemed simply sessile, hardly attached to the substratum, while others, smaller, showed something like a tap-root, white, cord-like, extending a few inches downward—not a root, certainly, rather the undeveloped base of the ball itself. Whence had all this wealth of organic matter come, and what was the meaning of it all? The previous existence of a wood-yard on the locality affords probable explanation of the phenomenon. Through and through the accumulated detritus of the old wood-yard the mycelium of the puff-ball had literally threaded its way, developing perchance for years over an area of not less than twelve hundred square feet, restoring again for the moment to the kingdom of life and light organic matter which seemed fallen into ruin irretrievable.

Turning our attention now to the fructification, we shall find our mushroom to consist of the following parts: A short stalk,

or stem, crowned with a cap, the *pileus*. This cap consists of an expanded disk, bearing on its lower surface hundreds of radiating plates, the gills or *lamellæ*, with sharp edges and delicately tinted, velvety sides. Cut a section perpendicular to the course of these plates or gills, and we have a comb-like structure which under a good lens presents the appearance portrayed in Fig. 2. Under still better lenses we may discover on each gill-section a marginal row of rather large cylindric cells, each bearing at its summit a pair of smaller cells manifestly formed by abstriction from diverging branches of the larger cell (see Fig. 3). The small cells are the spores, and the supporting cell but the terminus of an extended and much-branched hypha, which has blended with a myriad like itself to form stalk and cap and gill of our completed mushroom. That is the whole structure, and yet from such simple machinery behold what wealth and variety of form and style come forth! Other modes of spore-production there are to be hereafter seen, but that described is characteristic of the vast majority of those greater fungi which occupy the shadows of our world. To begin with, there are hundreds of species of agarics, fungi like the mushroom, differing from each other in matters of form and color chiefly, the attachment of stipe and gills, the stability and instability of the entire structure. Some, as the "ink-caps" (*Coprinus*), spring in the night and vanish in inky dissolution ere the sun ascends to midday; others, as the little woolly fungus with cleft gills (*Schizophyllum*), so common on fallen branches everywhere, survive the storms of many seasons and outlast the substratum on which they grow. Fig. 3 shows the elegant curvature of the cleft gill-plates, and the order in which they appear. New ones are constantly intercalated between those already formed.

FIG. 2.—SECTION OF THE LAMELLÆ OF COMMON MUSHROOM.

FIG. 3.—SCHIZOPHYLLUM COMMUNE, cross-section.

In all these the lamellæ run out in rays and remain quite gen-

erally distinct from one another; but here follows a series in which these plates all intersect, or wander in many a winding line and labyrinthine pattern (*Dædalea, Trametes,* etc.), until the intersections become so numerous as to form a perfect honeycomb whose cells are minute pores. The gummy, golden *Boleti* of the woodlands, and the common bracket-fungi (*Polyporus*) of every stump and log in all the forest, are examples.

FIG. 4.—SECOLIUM WARNEI, vertical section.

Even the puff-ball family—another section of the greater fungi—form their fruit in agaric fashion, and the connection between our mushroom and the giant "puffer," though at first sight remote, is yet not far to seek. It must be remembered that mushrooms when first emerging from the ground are quite contracted and closed, often like a closed umbrella—one of the old-fashioned sort, puckered around the margin with a string. Split such a mushroom at this stage, and all the lamellæ will be found with their edges close pressed against the sides of the stipes, the edge of the pileus close drawn round the bottom. Now, in autumn we may find a fungus looking exactly like an unopened toadstool; but you watch its opening in vain—it never opens. The puckering string never relaxes, the lamellæ never leave the stipe, but are indeed grown fast against it, and with maturity become wrinkled in myriad folds, finally to break down entirely, leaving a mass of dusty brown spores which escape only with the final rupture of the fragile, unexpanded pileus (Fig. 4). From such a fungus the puff-ball differs chiefly in degree; the spores are borne upon threads and fill up definite cavities, one or more, and are discharged, as in the case just described, by the rupture of the inclosing tissues. These latter here constitute a definite wall—the *peridium.* This may break open irregularly, or it may break regularly, throwing back from the top its pointed lobes

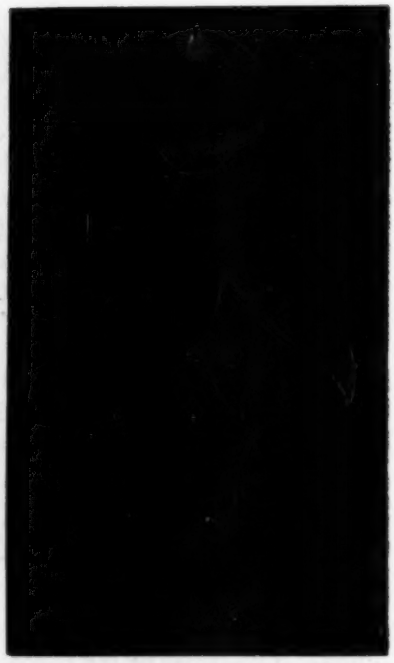


FIG. 5.—GEASTER FORNICATUS (after Morgan).

in roseate and star-like forms—earth-stars, beautiful as they are curious, and offering a singularly perfect mechanism for the dispersal of the spores. Here is an earth-star (Fig. 5) whose peridium consists of three coats—two outer, strong and leathery, and one inner, delicate, silk-like. The whole structure is developed as a smooth white ball beneath the soil. But, once the spores are ripe, the outermost peridium splits open at the top, its lobes spring backward and outward, giving room for the second covering to burst in similar fashion. The lobes of the second, however, by recurving, hoist the entire inner structure out of the ground and up into the air, where the inner peridium, enthroned thus upon springing arches, groined by no human hand, opens at tip a purse-like mouth, and suffers the spores slowly to escape, to sail on unknown journeys with the passing breeze.

We have space left but sufficient to mention the fruiting of the morel. Here we have on the outer upper side of the structure a layer of rather large elongate cells, quite similar to those on the mushroom gills; but, instead of abstricted spores on the outside of the supporting cells, we find each of the latter a fruit-case in which are lodged eight elliptical sporules arranged in a row, formed freely—that is, each entirely independent of the other and of the cell-wall that incloses all. But this method of fruiting brings us in sight of the microscopic and parasitic world of fungi, subject of our next chapter. Here, then, we well might rest; and yet, ere toadstools, mushrooms, and puffers vanish entirely from our thought, it were well to note, if but for a moment, the various titles these organisms wear. The names by which natural objects are known contain often in primary significance something of historic epitome; so, in the present case, we may discover the manner in which the object named first attracted human attention: the word itself is the record. Thus it appears that the word *fungus*, although coming to us from the Latin, is nevertheless of Greek origin, and is the same word as that we have anglicized in *sponge;* so that, according to the earliest record we have, the sponges of the sea and the fungi (puff-balls?) of the land were considered kin. Our Teutonic ancestors seem to have arrived at the same conclusion; and to this day, for a German, *Schwamm* is either a sponge or a fungus, as you like it. Nor less interesting is the etymology of our other common names for such plants. Toadstool is sufficiently plain, prosaic, and suggestive; mushroom would seem to be the English adaptation of a French word, *mousseron* (something growing in or among moss), evidently pronounced by Englishmen long before spelled, and evincing the fact that the quick French wit was first to discover the edible qualities of this as of so many other delicacies.

FABULOUS ASTRONOMY.*

By Prof. J. C. HOUZEAU.

THE darkness of the night exercised a sort of terror upon the minds of our ancestors. Just as material existence was supposed to succeed to nothing, and to be followed by it, day succeeds night, and this, they said, is the origin of time, as the winter is of the year. The Ostiaks of the Yenisei count their years by the snows, as also, or by winters, did the Iroquois of North America. The Numidians, Cæsar's Gauls, and the Germans of Tacitus, estimated daily periods by the nights. The night had a considerable importance in the North; and the Scandinavians had the most coherent and most poetical ideas of it. Day was the son of Night. The latter went first, a passage in the Edda says, mounted on her horse Rinfax, of the icy mane. Every morning, at the conclusion of his race, the courser watered the earth with the foam that fell from his bridle; this was the dew. Day followed, mounted on Sinfax, of the glowing mane, which lightened up the air and the earth. These people also believed that the longest night, that of the winter solstice, begat all the others, and that the world was created on such a night. Therefore night was called mother. Midwinter-night, or Yule, was the great annual festival, and marked the beginning of the new year. The Chaldeans said that the world began at the autumnal equinox, when the night became longer than the day. The French courts in the seventeenth century still ordered clients to appear within fourteen nights. The English *fortnight* is a contraction of this term.

The ancient Peruvians said that the moon was dead during the three days that it is invisible. The Khasias, of northeastern India, thought that the sun burned it up. Some savage tribes believe that the lunation is a quarrel between the sun and moon as husband and wife, identically repeated in every month. The increasing moon represents its gaining the ascendency, the decrease its yielding, till at last the sun swallows it and spits its head out in the sky. The ancient Slavs imagined that the moon was condemned to wander, for infidelity with the morning star. The Dakota Indians fancied that the declining moon was eaten by mice; the Polynesians, by spirits of the dead. The Hottentots said that, suffering from headache, it covered its face with its hand; the Eskimos, that, becoming tired and hungry, it retired to rest and eat, after which it recuperated very fast.

There is probably no country where some kind of a picture has not been made out of the visible spots on the moon. Two types

* From the "Bibliographie générale de l'Astronomie," by MM. Houzeau and Lancaster.

of figures, distributed according to a geographical rule, have predominated in these fancies. In Eastern Asia, it is a hare or rabbit. The Chinese and Japanese make it a hare. sitting on its hind-quarters, pounding rice in a mortar. The Hindus see a hare or roe; the Siamese, a hare, or, some of them, a man and woman cultivating their field. The North American and Mexican Indians symbolize the moon by a hare or rabbit; and some of the Central American monuments represent it by a jar or spiral shell with a rabbit coming out from under it. In South America, a human figure took the place of the hare. The Incas related that a light young woman, walking in the moonlight, was charmed by the beauty of the star, and sprang forward to embrace it. The moon took her up, and has kept her ever since. Some tribes, in both North and South America, make of the spots a woman bent with age. In Samoa, they see a woman and her child; on the Book Islands, men; in Timor, an old woman spinning. The Scandinavian Edda relates that Mane, who regulates the course of the moon in its quarters, placed there two children whom he saw carrying a jug of water hung between them from a pole. The Eskimos say that Anninga, the moon, brother of the beautiful Malnia, the sun, was pursuing his sister and about to overtake her, when she turned round and smutted his face and clothes with her fingers, which she had blackened with the soot of a lamp. The Khasias say that the spots are the cinders resulting from the monthly burning up of the moon by the sun.

French peasants variously believe that they see in the moon the traitor Judas, hanging from an elder-branch; turnip-Jack wheeling a barrow of stolen turnips; Cain leaning on his spade and looking at the murdered Abel; a peasant who has been caught by the moon stealing wood in his lord's domain; a peasant compelled to freeze in the moon with his bundle of sticks for making fence on Sunday; a hunter and his dog; or a she-goat and her keeper by a bush.

Eclipses of the moon attract more attention than those of the sun, because total ones are more frequently seen than those of the sun, and the darkness is of longer duration. The Peruvians supposed that they were an illness of the moon, and if total were a sign of its death, when it would fall to the earth and put an end to the world. When one occurred, they would beat upon everything that would make a noise, and chastise their dogs, in the faith that the star, witnessing the sufferings of the creatures it loved, would revive itself to save them. All would call upon the heavenly powers not to allow the star to die; and, when the light returned, praise was given to the great god Pache-camac, supporter of the universe, for having restored the moon, and thereby prevented the winding up of human existence.

The Caribs, and the Hurons as well, made a great din, upon drums and kettles, and by rattling loose pebbles in gourds, to frighten away the terrible demon Maboya, the author of frightful apparitions, pestilence, thunder, and storms, who was trying to eat up the moon. The French author Dutestre describes the Caribs, young and old, women and men, as dancing all night long, with their feet close together, one hand on their heads and the other on their hips, not singing but shouting lugubriously. Once beginning to dance, every one had to keep it up till daylight, without stopping for anything whatever. At the same time a girl would be shaking a gourd rattle and trying to keep her voice in tune with the din. While Eskimos were applying somewhat similar remedies, their women bored the ears of the dogs in the faith that, if the animals cried out, the end of the world was not yet at hand; for these animals are supposed to have existed before men, and to have a better presentiment of the future. The practice of those tribes which shoot arrows at the jaguar or shark, or whatever animal they may suppose to be eating the moon, is matched by the example of Alfonso VI, of Portugal, in 1664, who, learning that a comet was in sight, went out to look at it, scolded it, and fired pistol-shots at it.

While the story of the dragon which causes eclipses by devouring the sun or the moon is still current among the populace in Siam and China, the educated classes in those countries have mastered enough of the science of the phenomena to be able to calculate them. But in China the court and imperial authorities throughout keep up in form the primitive traditions. Under these traditions an eclipse of the sun was a warning to the emperor to look into his faults and amend them. The coming phenomenon having been pre-announced by the official astronomer,* notice of it was given throughout the country and the court made preparation for it by fasting and retreat. The appointed day was one of anxious waiting. The instant the star was touched, or when it began, according to the Chinese expression, to be eaten, the emperor himself gave the alarm by beating the prodigy-roll on the thunder-drum. The mandarins, who had come with their bows and arrows to succor the suffering star, shot into the air uninterruptedly. The Chinese *illuminati* know that these are only forms, but superstition still rules among the people, who throw themselves upon their knees at the beginning of the eclipse, and make a great noise with drums and gongs, to deliver the star from the devouring dragon. The Greek and Latin authors relate that a great noise was made during eclipses. The early Christians

* The astronomers He and Hi were condemned to death for having failed to predict, according to the requirements of the law, the eclipse of the sun that occurred in the reign of Tchong Kang, 2155 B. C.

rang bells during storms * and eclipses to counteract the action of bad spirits, to repel, with the priest's blessing, the darkness caused by phantoms—a survival, according to P. Lafitan, of the dark genii that devoured the moon.

The earliest observers of the stars had no suspicion of their true nature, or of the considerable distances that separate them from us. If they did not think them within reach of their hands, they supposed that they were, at least, almost in a literal sense, accessible to the voice. Homer says that the highest pines of Mount Ida passed beyond the limits of the atmosphere and penetrated into the ethereal region through which the clangor of the arms of his heroes reached to the sky. This sky was a solid hemisphere, a bell resting upon the earth, or, according to Euripides, a cover set over the work of the sublime artisan. The Hebrew psalmist, of the eleventh century before our era, said to the Lord, "Thou stretchest out the heavens as a pavilion." The stars of Anaximenes were fixed in this vault like nails. The celestial bell covered a flat earth which was surrounded by water on every side. Every people imagined itself in the center of it, and China is still "The Middle Empire." The Incas exhibited this center in their sanctuary of Cuzco, the name of which signified *navel*, as the Greeks also saw it in the Temple of Apollo at Delphi, which was also called the navel (ὀμφαλός) of the world, and was celebrated by Pindar under that name. The Chinese located the navel of the earth in the city of Khotân. The conception of the earth as flat and like a cake prevailed in European civilization till the Crusades, and the *lazzaroni* of Naples have it still.

The Hawaiians, Maoris, and Eskimos supposed that the whole sky was supported by a pillar, as the ancients fancied it upheld by Atlas. The Iroquois thought it was fluid.

The Polynesians explained the revolutions of the sun by supposing that the great god Meni held it by a cord.

The shepherd of Sapta Sindhon regarded the stars as fires kindled by Agni (the elementary fire), or by Varuna (the celestial vault). A hymn which he addressed to the gods mentions the moon with icy rays to signalize its powerlessness against the divine fires of heaven. (It is to be remarked that the moon is often spoken of as a frozen place—probably in reference to the difference in temperature between day and night.)

The milky way, which was Winter's path to the Scandinavians, was the road of souls for some of the American nations; the souls entered the world by the door situated where it intersects the zodiac in Gemini, and quit it to return to the gods by the door of Sagittarius. French peasants still call it St. James's road; mythology attributed it to the milk that dropped from Juno's breast

* This practice was kept up till the last century.

while she was suckling Hercules. It was the celestial river of the Chinese, a shark-infested creek to the Tahitians; to another tribe, the field where their ancestors hunted ostriches; star-dust to the Peruvians. The Pleiades were regarded by the Iroquois and some of the ancients as a group of dancers, and are still figured in some parts of Europe as a hen and chickens. A tribe called the Chokitapia are said to have regulated their festivals by the appearance and disappearance of this group. When they disappeared, in the autumn in that country, was the time for beginning farm-work, the feast of the men; and the feast of the women was celebrated on their reappearance. The former festival referred to the burial or combustion of the seed; the latter to the return of the absent. The day before the reappearance of these stars the women rejoiced and danced around a pole. In the autumn, the dance of the dead was held. Women swore by the Pleiades, and men by the sun. In all religious festivals the calumet was presented toward the Pleiades, and prayers for happiness were addressed to them. These Indians believed that the Pleiades were seven young persons who guarded the holy seed during the night and executed a sacred dance over it. Epizors, the morning star, charmed with their grace, took them to the sky, where the stars were cheered by their gambols. The sand-dance of Malay warriors may convey some idea of this celestial dance. The bath of purification, prescribed by some of the medicine-men, comprised a triangular hole in which seven hot stones were dropped and covered over with cold water. In their invocations, the medicine-men prayed the Pleiades to help them heal bodily diseases. For talismans, they had seven bones, seven balls, or seven buttons.

The period of fifty-two years formed a complete era for the Aztecs, and they questioned whether at the end of that period the great heavenly clock, having performed its revolution, might not stop forever. This era menaced a considerable number of the population once in their lives, and some of them perhaps twice. The night on which the fifty-second year would expire was a solemn moment to them, and was signalized by extinguishing the sacred fires in the temples and those on private hearth-stones, and by breaking all vessels that had contained provisions; and the evening was passed in darkness, with trembling and fear. The day was in November, when the Pleiades would culminate at midnight, and this moment was the termination of the century. As the hour appeared, the human victim was sacrificed, and the sticks were rubbed over his still quick body for striking the fire for his funeral pile and the inauguration of the new era. Men were waiting with torches ready to be lighted, with which the new fire was to be distributed to all the provinces. The moment of midnight was hailed with shouts of joy. The world had not

come to an end, and men could hope that it would last at least through another era. Those who could not attend the public ceremonies watched kneeling on the roofs of their houses. The secular festival was suppressed by the Spaniards, the last human victim having been sacrificed on the pyramid of Tlaloc in 1507. —*Translated for the Popular Science Monthly from a review, by M. L. Barré, in the Revue Scientifique.*

THE PRODUCTION OF BEET-SUGAR.

By A. H. ALMY.

IN the May number of this magazine a sketch was presented of the rise and progress of the beet-sugar industry. In this article it is proposed to outline the method of growing the plant, and the processes employed in extracting the sugar. The sugar-beet, like other plants, contains a definite number of chemical elements which are indispensable to its growth, and which must be present in suitable proportions in order to insure its highest development. Yet it is not long since the proportions of these constituents were looked upon as merely incidental, and without any direct bearing on the processes of growth. Plants are nourished by air, water, and the substances contained in the soil; but they differ in the kinds and quantities of nourishment required. Some need to have their roots constantly in water, others are best suited to dry soils, and others again prosper only on the best and most richly manured land. There are some elements common to all plants, and some peculiar to each kind. Like animals, plants are endowed with taste or choice regarding their food—they do not absorb indiscriminately nor in the same proportions all the substances presented to them. From this it follows that the fertilization of the soil should be adapted to the character of the plant that is to be cultivated. Wheat, rye, barley, and other cereals push up long stalks having few and slender leaves, which absorb little nourishment from the air. These plants consequently take most of their food through the roots, and are, therefore, great exhausters of the soil. Plants, on the contrary, having large, fleshy, green leaves, like the beet, take greater quantities of carbonic acid and water from the air, and hence withdraw less material from the ground. In the process of growth plants exhaust that portion of the soil which comes in contact with their roots; hence, after the surface layers have been drawn upon by short, creeping roots like those of the cereals, a long tap-root, like that of the beet, may be able to extract an abundance of nourishment from the deeper layers.

The mechanical condition of the soil is another important factor in the cultivation of the sugar-beet. From the closeness of its texture, a stiff clay retains water, and does not readily admit heat or air among its particles; it also opposes much resistance to the fibrous roots making their way through it. By preventing the free growth of the roots downward, clay is especially unfavorable to the sugar-beet crop; for the beet, instead of producing the long, slim root which is necessary for the proper secretion of saccharine material in the sugar-cells, grows round, turnip-like roots, which are of no value for sugar-making. Sand is the opposite of clay, and, from the looseness of its texture, admits heat too freely, and is not capable of retaining a sufficient amount of moisture for the needs of vegetation. In sand, also, the particles of plant food are washed down by the rains below the reach of the roots, or are vaporized by heat and escape into the air. Plants grow best in loam, which is a mixture of these soils of opposite character, in such proportion that the faults of both are corrected. The depth of the soil and the nature of the underlying stratum are also important; for if the richest soil is only seven or eight inches deep, and lies on a cold, wet clay or on rock, it will not be as fruitful as a leaner soil that lies on gravel, for instance, which is perhaps the best subsoil. The best soil for the cultivation of the sugar-beet root is a mellow, sandy loam, with a free and permeable subsoil, such as would be called by the German agriculturist a first-class barley soil. It should be ten to sixteen inches deep—the deeper the better—rich in well-decomposed organic matter and minerals.

Ordinary land can not be planted with the same crop year after year without a gradual diminution of product. This is owing to the fact that the specific food of the particular plant is exhausted from the soil by the constant drafts upon it. But if the land is planted one or more years with a vegetable which takes a different kind of nourishment from the soil, time is allowed for the chemical changes constantly going on in the ground to produce a supply of the food required by the first kind of crop. In the cultivation of the beet-root for sugar-producing, it must follow the cereals, such as wheat, rye, and barley, but, to be profitable, not oftener than every third year.

The advantages of correct fertilization in the cultivation of the beet-root are shown by the experiments of Lawes and Gilbert. On one acre of ground, cultivated without manure, 302 bushels of beets were grown. On another acre adjoining and possessing the same characteristics of soil, enriched with 550 pounds of nitrate of soda or Chilian saltpeter, 886 bushels of roots were obtained. The beets grown without manure contained 2,115½ pounds of sugar per acre; the beets grown with the mineral nitrogen con-

tained 5,145 pounds per acre. In other words, with the use of a fertilizer, an increase of 3,030 pounds of sugar was obtained.

The application of highly nitrogenous fertilizers, or the incorporation of partly decayed organic substances—like stable manure—in the soil in the autumn or in the spring, directly preceding the cultivation of the sugar-beet, is known to act injuriously on the composition of the roots. Such manuring increases the foreign substances in the juice, prevents a desirable development of the sugar, besides placing the latter under unfavorable circumstances for separation. Thus no fertilization must be used during the year of the beet crop.

After the plowing and harrowing of the soil, much the same as required for a potato crop, leaving the ground as smooth as a garden, the sowing of the seed commences early in the month of May, when the *beet-planter*, represented in Fig. 1, is brought into requisi-

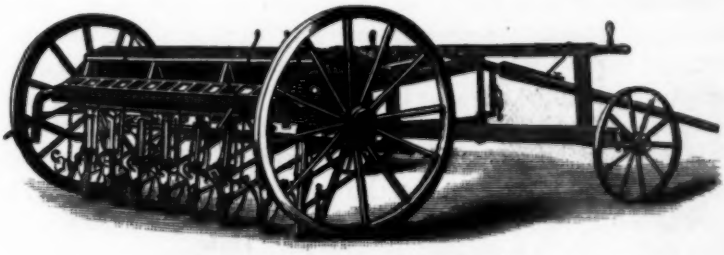


FIG. 1.—THE GERMANIA BEET-PLANTER.

tion. Like the mower, reaper, binder, and other agricultural wonders, it saves the labor of many workmen. It is drawn by two horses, and plants eight rows, eighteen inches apart, at each passage. The seed is placed in hoppers extending along the top of the machine; thence it descends through chutes or apertures, which can be enlarged or contracted at pleasure, into the body of the machine. A shaft, furnished with small spoons, runs through the body of the machine, and is made to revolve with greater or less rapidity by an arrangement of cog-wheels connecting the shaft with one of the driving-wheels. At each revolution each little spoon brings up a seed and deposits it in a small hopper, from which it descends through a series of funnel-shaped tubes, which telescope into each other, into the seed-box of the drill. Another series of cog-wheels is set in motion by the other driving-wheel, and these cause another shaft to revolve, faster or slower, according to the arrangement of the wheels. This shaft is furnished with eight wheels, with cams or projections on the circumference, which operate the valve-rods that open and shut the seed-boxes in the drills, and thus this gearing regulates the distance at which seeds are dropped, just as the other regulates

the quantity of seed deposited in the seed-boxes. The seed-drills are furnished with little plows, which open furrows for the seed, deeper or shallower in proportion as they are laden with weights provided for the purpose, and, being hung on pivots, they readily adapt themselves to any inequalities on the surface of the land. In returning across the field, the inner wheel follows in the track made by the outer one in going, and thus the last row of a twenty-acre field is parallel to the first, and the spaces between the rows are uniform. With land thoroughly prepared, and with men and horses practiced in their work, the machine could plant twenty-five to thirty acres per day.

The *beet-cultivator,* Fig. 2, is also drawn by two horses, and cultivates five rows at each passage. It consists mainly of five

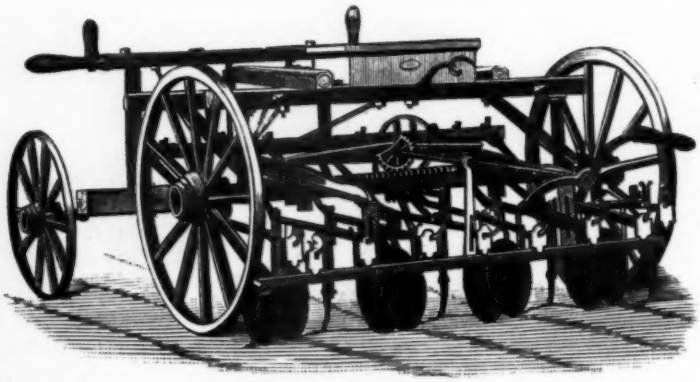


FIG. 2.—THE BEET-CULTIVATOR, WITH ATTACHMENT FOR PROTECTING THE YOUNG PLANTS.

sets of scuffles or hoes, set in a framework, suspended between the hind-wheels of the machine. By means of a lever, terminating in a cog-wheel and playing on a cogged semicircle, this frame can be moved from side to side, or elevated to pass over obstructions, or for convenience in going to and returning from the field. Each set of hoes comprises three different forms of implements adapted to the cultivation of the crop at different stages of its growth. The first set consists of a broad, single scuffle, almost as wide as the distance between the rows; this is intended to be used about as soon as the rows can be traced, and it is provided with a contrivance which bestrides the rows, and protects the young plants from being covered with earth. The second set of implements consists of two narrow scuffles, which penetrate and stir the soil to a greater depth, and are used after the plants have been thinned out and have grown stronger, and there is no longer any danger of covering them with earth. The third set, connected with the beet-cultivator, is a kind of double mold-board plow, and is used for the last hoeing or hilling, Fig. 3. The shape and use

of these implements will be seen by reference to the diagrams, which illustrate the cultivator rigged for use at different stages of the growth of the crop.

Every seed-vessel of the beet, containing from two to three germs, will produce as many plants, of which the strongest is left,

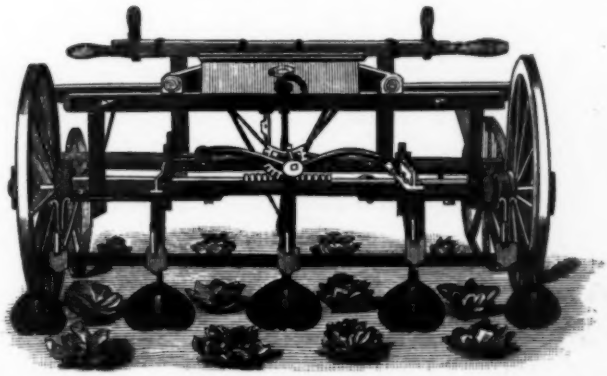


FIG. 3.—THE BEET-CULTIVATOR, WITH ATTACHMENT FOR COVERING THE ROOTS AT THE LAST HOEING.

while the rest are pulled up or otherwise destroyed. The process of thinning out the plants, not unlike the same operation in the cultivation of corn, takes place after the first passage of the cultivator, as soon as the roots have reached the length of from four to five inches. The remaining plants are six to eight inches apart. The soil around the young plant is frequently loosened by the beet-cultivator, as shown in Fig. 2, every two or three weeks, until the leaves have acquired their proper development early in June. This treatment, by destroying the weeds and increasing the general absorbing properties of the soil, favors an undisturbed and early development of the leaves, which have a controlling influence in the formation of sugar.

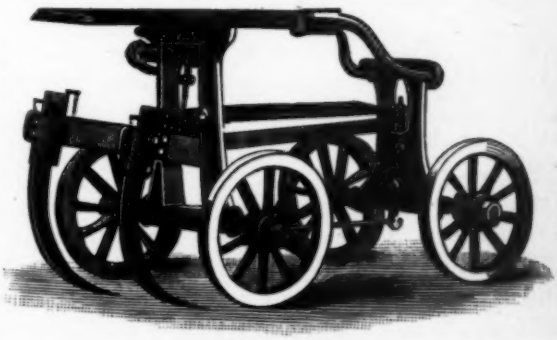


FIG. 4.—THE BEET-DIGGER.

The *beet-digger*, Fig. 4, is a powerful machine, also drawn by two horses. It consists of two long knives or coulters, fixed in a heavy framework, and so arranged that they may be set to run to a greater or less depth, as may be desired. These knives run under and lift two rows of beets at each passage. As the machine

passes along, only a slight rippling or undulating motion is observed in the rows of beet-tops, but the roots are loosened and cleared of dirt more perfectly than could be done by hand, and, as no roots are broken or left in the ground, a considerable increase in the crop is obtained. Like the beet-cultivator, the digger is steered by a lever at the hind end of the machine, and can be lifted to pass over obstructions and for convenience of travel to and from the field. The beets being raised out of the soil, and the leaves cut off with sword-like knives about one half to an inch above the root, the harvesting is completed by the removal of the roots to the pits or factory.

These machines are constructed to work with mathematical exactness, and are used in Germany with great success, and accomplish a very important saving of labor. They have also been experimented with at the Massachusetts Agricultural College with the same results. It is obvious that the smoother and more level the land, the better for cultivation; but the beet machinery will do good work on rolling and uneven land. The beet-planter, or any part of it, may pass over stones or mounds without interfering with its operation, ample provision being made to enable each part to adapt itself to the inequalities of the land. Finally, the crop must be kept free from weeds until harvested, otherwise the root-lifter, which on clean land is a model of simplicity and effectiveness, will be clogged and will not work at all. In short, it requires and abundantly rewards careful preparation of the land, punctual performance of the various operations of tillage, and perseverance in destroying weeds. We may say, this machinery is well adapted to the culture of other crops, particularly corn.

The estimated cost of the cultivation of the sugar-beet per acre, without machinery, on the farm in New England, is about the same as for a crop of onions, corn, or potatoes, and, exclusive of fertilizers, may be estimated as follows:

Fall plowing	$2.00
Spring plowing	4.00
Harrowing	2.00
Marking and planting	1.00
First weeding and thinning	3.00
Cultivator with horse, three times	4.50
Total	$16.50

It would be impossible, within the limits of this article, to describe in minute detail all the approved methods for the manufacture of beet-sugar; but an attempt will be made to give a general idea of the different processes, with a description of some of the ingenious mechanical contrivances introduced during the past

decade, which have been important agencies in making it possible to manufacture beet-sugar at a profit. The method of extracting the sugar from the beet-root is entirely unlike the one usually employed in manufacturing sugar from the cane-plant, but the principle of the former is equally applicable to the latter, and will probably be generally adopted when the cane-sugar manufacturer can afford to replace his old mechanical system with rotary diffusion batteries.

The beet-roots are dumped, by the farmers, into large bins about nine hundred feet long, capable of holding five thousand tons of beets, from which they are dropped by adjustable traps into a concrete ditch or canal, underneath the beet-house. This canal is provided with descents of brickwork or metal gutters, through which the roots are borne by the rushing water into the wash-house, which constitutes the first stage of the factory. In the wash-house is a large screw or raising wheel arrangement, by which the beets are emptied into a hopper on the second floor,

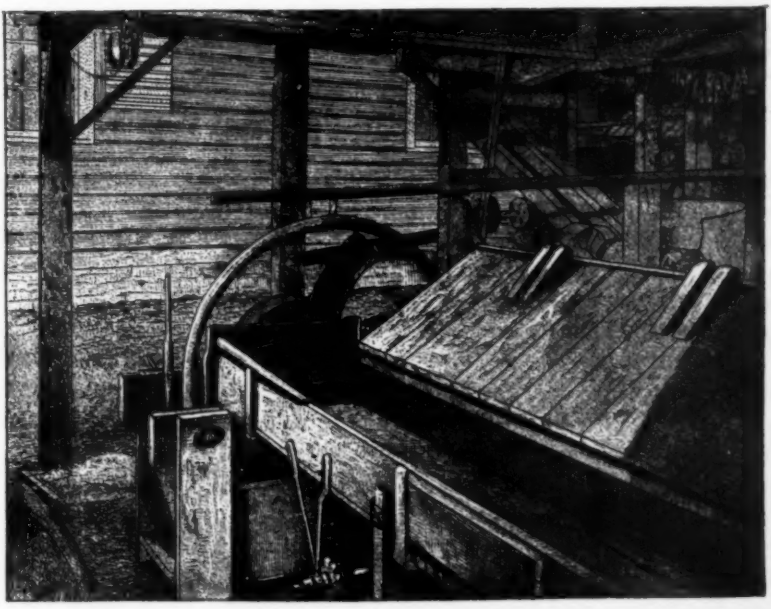


FIG. 5.—THE BEET-CUTTER.

from which they pass into a large, drum-shaped iron cylinder, called the *wash-barrel*, where the roots are thoroughly cleaned. The washing of the beet is a very important operation in the manufacture of the sugar, for the roots are thus freed from mold, small stones, and other kinds of dirt attaching to them, which not only saves the machinery employed in the actual preparation of the beets from injury, but keeps the sugar ultimately obtained free

from impurity. With the mere washing of the beets the sugar manufacturer is not content; they are therefore freed from those parts which are poor in saccharine, damaged or otherwise undesirable, by a machine called a *carousal.*

When cleaned, the beets are thrown from the wash-barrel into a hopper, from which they pass into an endless elevator which carries them to the top floor, where they are discharged into a large hopper. They then pass into a *cage* which will hold one thousand pounds of beets, and, when this weight is indicated, the cage empties its load into the *cutter* or slicer, Fig. 5. The cage and the indicator enable the factory people to closely estimate the amount of raw material used each day. It is also a check on every department. It will show any error that may arise in the receiving or shipping departments. The slicer is a round iron shaft, rotating horizontally, and fitted with steel knives capable of slicing four hundred tons of beets in twenty-four hours. The rotating knives, which descend upon the beets, cut them into thin slices, thus exposing the sugar-cells, which is an important factor in the diffusion system. The lower end of the cutter opens into a wooden trough about two feet square, on the bottom of which is an endless belt. As the sliced beets fall from the cutter, the belt carries them along to the diffusion tanks.

In alluding to the operation of the *diffusion battery* in the article on "Growth of the Beet-Sugar Industry," it was said that "though simple in its conception, it nevertheless illustrates well-known laws of chemical science in the transfusion of liquids, and successfully opens the membranous walls of the sugar-cells of the plant, giving a higher grade of juice, with less gummy, nitrogenous, and fibrous impurities, at less cost than by the old methods of mechanical pressure." By membranous diffusion is understood the process of exchange between two fluids of unequal density, contained in two vessels separated only by a membrane. Supposing the sugar-cells to be brought in contact with pure water, then, theoretically, if the cells contain twelve per cent of sugar, transfusion will go on till an equal weight of water contains six per cent of sugar, while by the passage of water into the cells the juice there is reduced to the same degree. Taking the six-per-cent watery solution and treating with it fresh roots containing twelve per cent of sugar, a nine-per-cent solution will be obtained, which, on being brought a third time in contact with fresh roots, would be raised to a density of 10·5 per cent. Thus, seven eighths of the whole sugar would be obtained at the third operation, and it is on this theory that the diffusion process is based.

A *diffusion battery,* Fig. 6, consists of a range of twelve large, close, upright cylinders called diffusers, provided with man-holes above and perforated false bottoms, with a like number of heaters,

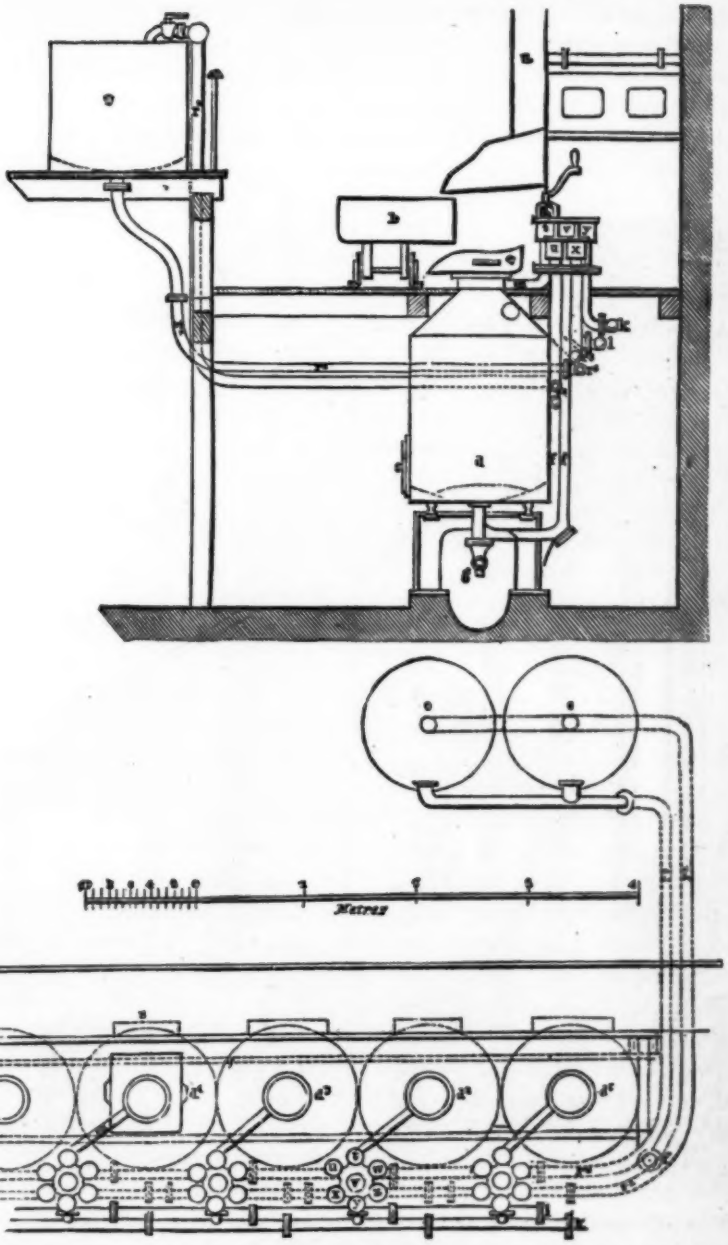


FIG. 6.—VERTICAL AND HORIZONTAL SECTIONS OF ROBERT'S DIFFUSION BATTERY (Stammer).

a, root-cutter; b, charging-car with weighing attachment; c, movable hopper; d, d^1, d^2, d^3, etc., diffusers; e, reheating-reservoir; f, communicating-tubes between diffusers; g, discharge-tube; k, conducting-tube for displaced water or juice; l, safety-tube connecting with all the diffusers, and serving to disconnect a defective one; t, u, v, x y, z, valves corresponding to the various tubes; m, tube joining valves with diffusers; r^1 and r^2, etc., conduits between reheaters and diffusers; w and u, valves corresponding with same; r^3, conduit of juice to defecators; s, manhole for exit of exhausted slices.

arranged in alternation with the diffusers, revolving on a center. As the pure water from an elevated tank percolates through the mass of the two or three tons of sliced beets, under a pressure of eighty pounds, the fluid contents of any one cylinder can be forced into another through the communicating pipes, and thus—under

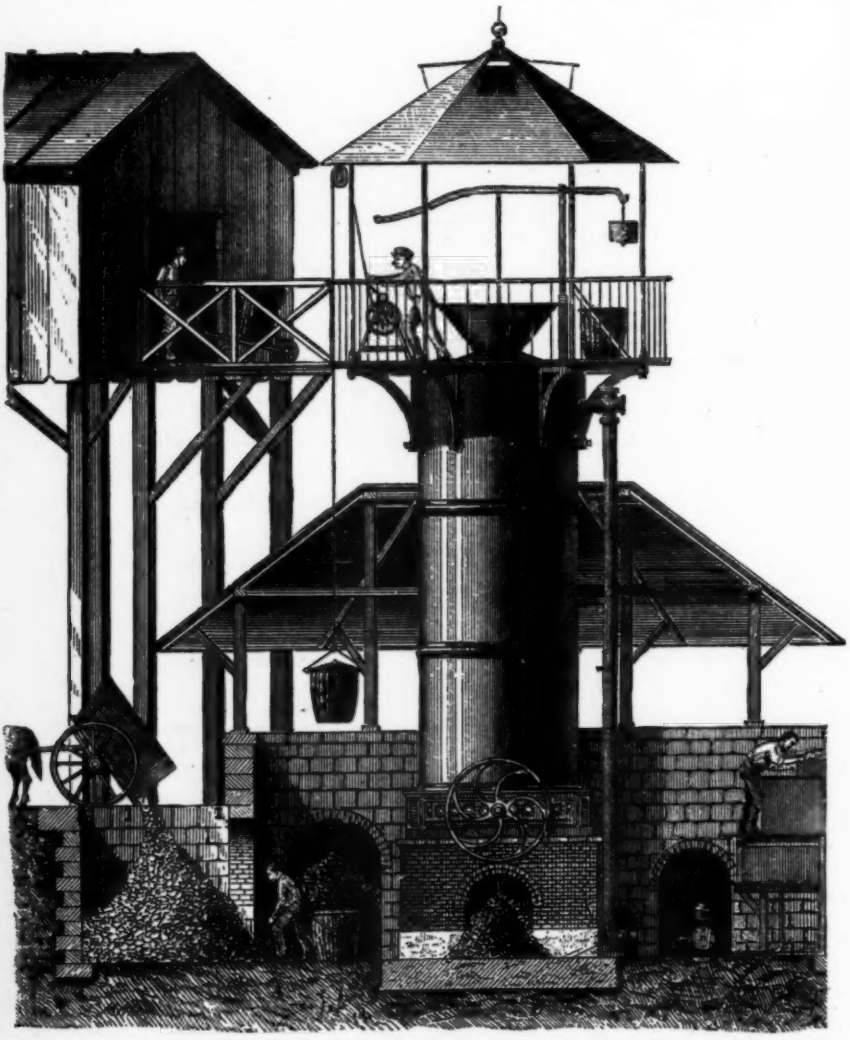


FIG. 7.—FURNACE FOR SUPPLY OF LIME AND CARBONIC-ACID GAS TO FACTORY ("Journal des Fabricants de Sucre").

the combined influence of heat and pressure—the whole solution becomes richly charged with sugar. From cylinder No. 1, which contains the slices almost exhausted of their soluble contents, the fluid passes into No. 2, where it acts on slices somewhat richer in juice. So it goes on through the series, meeting in each cylinder

slices increasingly rich in juice, and acquiring density in its progress. Before entering the last cylinder the solution is heated, and the richly charged fluid is sent forward to the carbonation tanks. This process of saturation consists in the treatment of the diffusion juices with lime and carbonic acid, whereby the non-saccharine substances are precipitated and partly decomposed,

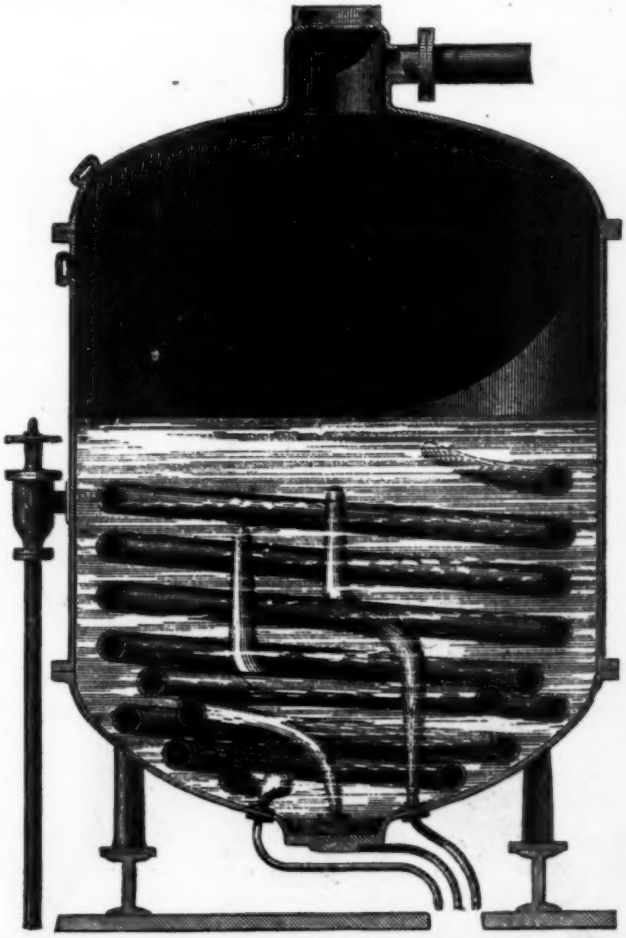


FIG. 8.—VACUUM STRIKE-PAN, VERTICAL SECTION (Maumené).

the sugar remaining unaltered in solution. These foreign or non-saccharine substances, which are present in the juice in considerable proportions, would interfere with the crystallization of the sugar.

The carbonic-acid gas is generated in a lime-kiln, Fig. 7, which consists of a hollow circular chamber of incombustible material provided with furnaces and delivery apertures, and is generally placed in the open air in the factory yard. The lime and carbonic-

acid gas are obtained by the decomposition of marble chips by a fire of coke and a bath of sulphuric acid. The process of saturation being complete, the juice is drawn through sand-catchers by means of a lye-pump, which conveys it under pressure into the filter-presses of the first saturation, where the precipitated substances are received. The presses consist of a number of four-cornered plates or frames, over which cloths are stretched. The

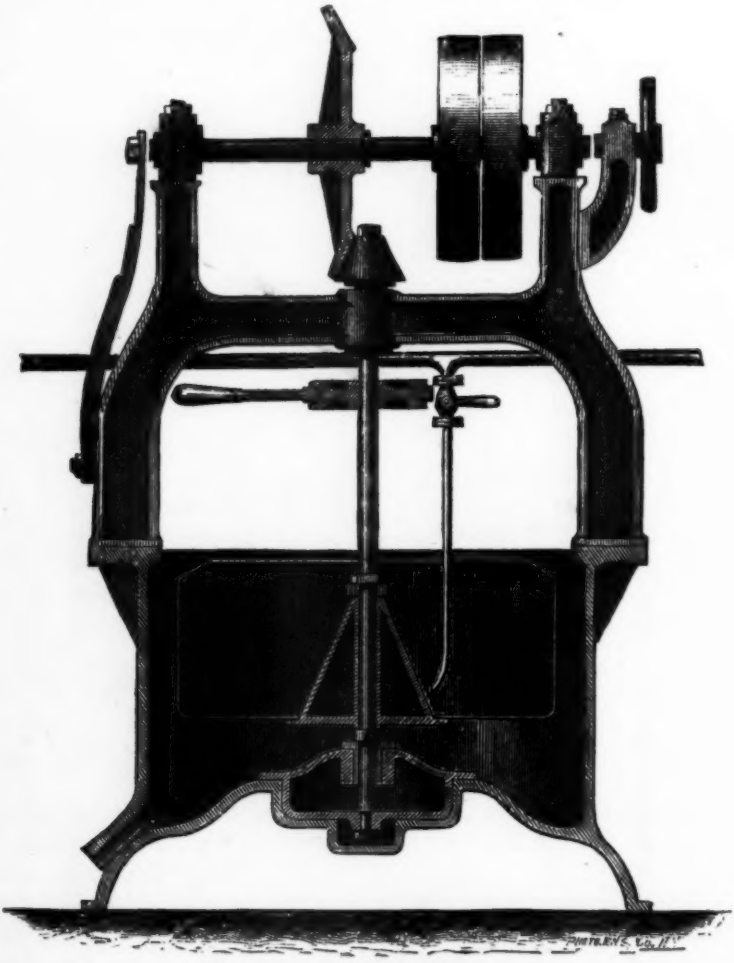


FIG. 9.—CENTRIFUGAL FILTER (Maumené).

residuum is deposited between the plates or in the frames, as the case may be, while the fluid passes through the cloths before leaving the press, and is thus filtered.

From the presses the liquid mass passes to the *evaporator*. This consists of one or more cylindrical vessels, either in a vertical or a horizontal position, according as its effect is single,

double, triple, or quadruple, and provided with a system of heating pipes. The steam which proceeds from the boiling juice of the first vessel serves to heat the second vessel, and so on through the entire series. The evacuation of the heating system on the evaporator is effected by means of small tubes leading from one vessel to the other and connected with a condenser.

When the sirup has attained to a certain degree of concentration, it is drawn off by means of pneumatic suction direct into the *vacuum boiler*. The vacuum boiler, Fig. 8, consists of a vertical, cylindrical, or ball-shaped vessel, with a conical base, containing heating worm tubes. The mass obtained from the vacuum boiler is first of all placed in a refrigerator, which consists of a trough provided with a stirrer and a refrigerator jacket. The mass of sugar crystals must now be separated from the sirup, so that raw sugar may be obtained, and hence it is sent forward from the refrigerator to the centrifugal machines.

A centrifugal machine, Fig. 9, consists of a cylindrical drum, over which is a finely perforated sieve, and which rotates with great rapidity on its own axis. The mass placed in the drum is pressed against the sieve by the action of centrifugal force, and the fluid escapes through the small apertures. The sirup having been disposed of, the yellow sugar obtained is called the first product, and this, having been emptied from the drum, is transferred to another sieve, where it is freed from the lumps which it may contain, and the raw sugar is finally emptied into sacks on the lower floor, when it is ready for the refinery. The process of refining raw sugar into the block sugar of commerce is an independent industry.

MISCHIEF-MAKERS IN MILK.

By ALICE B. TWEEDY.

VERY recently it was announced by Proust that the bicarbonate of soda used as a preservative of milk formed a compound particularly injurious to children—i. e., the lactate of soda.

There appears to be great danger, in the newly aroused fear of fermentative changes in food and of the baneful products of the busy bacilli, that any vaunted preservative or germicide may be greedily seized upon at once, without thought as to the innocence of its chemical activity. This easy credence in antiseptics seems to be characteristic of the minds that shrink with most unreasoning fear from every advance in bacteriological research. Not long since, a novelist, more imaginative than scientific, arraigned Science because "the idea of the comma bacillus is more dreadful than that of the cholera." This, as an outburst of ignorance, would be

excusable, preferring the known horror to the immeasurable unknown. But, to one acquainted with the fact that infinitesimal life swarms about and within us, why should it be terrible to learn that some forms are coincident with disease? If we thrive upon palpitant air, drink water* populated with bacteria, and shelter millions of microbes in our bodies, why should we tremble to find a few unfriendly species that we can not safely entertain? We talk glibly of "pure air" and "pure water"; but, to be exact, we have only a laboratory knowledge of either, and might as well try to rid ourselves of our surplus population as to provide ourselves with these elements in a sterilized state.

"Dead" and "undesirable" may be equivalent terms in regard to air and water, but we do not yet know whether they can be applied to food. All of the bacilli that visit our articles of diet seem to herald some fermentative or putrefactive change. Sometimes these are agreeable to us, and we aid them in their work of creating yeast, wine, and kumyss. Even then we watch closely and fix a limit to their activity. Generally, we are squeamish about their advent in meat, milk, cheese, or eggs, having dire experience of the alkaloids that they manufacture. And, it must be noted, it is not the bacilli themselves that give us trouble; for all we know they may be as digestible as the cholera bacillus was to M. Roche Fontaine. It is the physiological result of their sojourn in the food that constitutes the danger—the unfortunate remainder, or ptomaine, that may be fatal to us. This ptomaine is an alkaloid formed from the medium in which the organism exists, and includes whatever substance may be left of the bacterium itself. Just as man changes the atmosphere about him by exhaling carbonic-acid gas and various solid particles of matter, so the bacillus decomposes the tissues and fluids of the body in which it resides.

Nothing more wonderful than this work of disintegration is revealed to us in the economy of Nature. The picture of species after species accomplishing, by a brief life, one step toward the final resolution of organic matter into the elementary products, is not surpassed by a study of the glacial chiseling of the rocks, nor of the marvelous influence of the earth-worm in fructifying the soil.

Obviously, we can not wait for the manufacture of any poison, but must make it an impossibility, if we can, without rivaling any of the toxic effects by our remedies. Acquaintance is occasionally made with the ptomaine before the guilty micrococcus is known; in such cases even more care must be exercised.

Following the investigations of Lister and Hueppe, the ordi-

* A cubic centimetre of wholesome water may contain from 53,000 to 770,000 colonies of bacteria.

nary fermentation of milk is traced to the growth of a micro-organism known as *Bacterium lactis*, which converts the milk-sugar into lactic acid. The work of decomposition is then taken up by another bacillus, named *subtilis*, through which butyric acid is produced. Recent experiments made in the cultivation of milk bacteria by Baginski * indicate that the *Bacterium lactis* is incorrectly named, and, being responsible for an acetic-acid formation, is better termed *aceti*.

There is also a peculiar fermentator, *Bacterium coli*, that refuses to meddle with milk-sugar alone, but upon the addition of white of egg shows extraordinary activity, furnishing lactic, formic, and acetic acid. These three—*Bacterium aceti*, *Bacillus subtilis*, and *Bacterium coli*—are the normal visitants † of milk, and the changes dependent upon their presence are well understood. The micro-organisms that breed disease and death appear under exceptional circumstances, against which, so far as they are known, we may carefully guard.

The bacilli of phthisis, typhoid, and scarlet fever have been detected in milk supposed to be wholesome. Thorough inspection of cattle and dairies may reduce the frequency of infection; but, until such supervision is the rule, all danger can be avoided by boiling the milk. In the late Congress at Paris on the study of tuberculosis, Dr. Nocard advised this to be done in every case where there existed any tendency to consumption.

A peculiar sickness,‡ which in its malignant form is similar to anthrax, has been traced to a germ occurring in milk. The conditions required for its development are known, and have been artificially produced by feeding cattle with fodder exposed to the dew-fall. The poison is found in sweet milk, butter, cream, and cheese, but not in buttermilk. It is either formed in small quantity, or has the property attributed to it of self-attraction. Neither the ptomaine nor the bacillus producing it has been determined, and they offer a new field for experiment.

The chief mischief-maker is yet unknown, unless it may possibly be identical with the micrococcus * found by Dr. Sternberg in cheese. Its ptomaine,‖ however, was isolated by Prof. Vaughan, of the University of Michigan, in 1885, and was called, from the substance in which it was discovered, *tyrotoxicon*—cheese-poison.

The history of this discovery is interesting. Three hundred cases of cheese-poisoning were recorded in Michigan by the Board

* "Report of the Physiological Society of Berlin," January 18, 1889.

† Twenty-three varieties of bacteria were found in intestines of milk-fed infants suffering with summer complaints (Dr. Booker, Baltimore).

‡ "Science," New York, 1886, vol. viii, p. 482.

* "Report of the Board of Health of Michigan," 1884–'85, vol. xiii, p. 218.

‖ "Ptomaines and Leucomaines," Vaughan and Novy, p. 56.

of Health during 1883 and 1884. Although none of these were fatal, the illness was in some instances alarming, and the evil effects were confined to twelve different cheeses. Samples of these were sent to Prof. Vaughan for analysis. The cheese exhibited no unusual taste or odor, but a dog, with keener instinct than the human, selected a piece of untainted cheese in preference. The detection of the poison proved to be a difficult task. The ptomaine was volatile and unstable, and a method had to be invented for its isolation. An alcoholic extract of the cheese fixed the poison in a fatty acid. An aqueous extract was made and evaporated, when the poison also disappeared. Two years of patient study perfected the process, and Prof. Vaughan succeeded in separating the ptomaine in crystalline shape. During the same year he obtained tyrotoxicon from milk kept in stoppered bottles in the laboratory.

In 1886 there occurred some cases of mysterious poisoning at Long Branch. Twenty-four persons became suddenly ill at one hotel, nineteen at another, and in the following week thirty more complained of similar symptoms. The investigations conducted by the chemists, Newton and Wallace, established the fact that tyrotoxicon was the cause of the sickness. The conditions in which the poison was generated are given in the report as follows: "The noon's milking—which alone was followed by illness—was placed while hot in the cans, and then, without any attempt at cooling, carted eight miles during the warmest part of the day in a very hot month"! Milk-poisoning in Iowa and Michigan was subsequently traced to the formation of tyrotoxicon; and, in India,* an English surgeon, Firth, discovered the same ptomaine in milk that occasioned sickness.

It might be supposed that so favorable a *nidus* as custard would not be overlooked by the mischievous bacillus. After Vaughan's method of isolating the ptomaine was made known, many analyses of poisonous ice-cream and cream-puffs testified to its industry. Wherever this toxic agent was identified, the circumstances attending its growth were carefully studied, and the care of the milk, cream, or custard was found to be faulty. In some instances cleanliness had been strictly observed, but other conditions inducing fermentation had been overlooked. In the milk-poisoning at Long Branch proper airing and cooling of the milk were neglected. In Milan, Mich., three fatal cases occurred in the tidy home of a farmer's family. Examination showed that the buttery where the milk was kept had a new floor laid over decaying boards, and some of the dirt accumulations between these, taken to the laboratory, generated tyrotoxicon in fresh milk. In Lawton, Mich., the custards prepared for freezing stood for some hours in

* "Indian Medical Journal," Calcutta, 1887, vol. vi, p. 1.

an unventilated building formerly used as a meat-market. The ice-cream made from them poisoned eighteen persons.

According to Prof. Vaughan, tyrotoxicon does not develop below 60° Fahr., and is anaërobic—grows when air is excluded. Some very simple measures, then, are preventive:

1. Scrupulous cleanliness.* A little dry milk on the rim of a can or vessel may breed the germ which will find a culture-ground in fresh milk.

2. A low temperature—below 60° Fahr.

3. Ventilation in an untainted atmosphere.

It is but just to say that these precautions are generally observed by careful dairymen and cream manufacturers. There is grave reason to fear, however, that they are not generally observed after the milk reaches the consumer's hands. Also, the slightest carelessness may affect seriously that class of the community which does not speak for itself—the very youngest.

The symptoms of cholera infantum† and poisoning by tyrotoxicon have been proved experimentally to be very much alike, if not identical. Even the *post-mortem* condition of children dying with this complaint is shown by Prof. Vaughan to agree exactly with that caused by tyrotoxicon-poisoning in animals. The enormous per cent of deaths from the disease occurs between the ages of six months and two years, proving conclusively that heat and atmospheric conditions can not be the potent causes. There is only one differing factor in the life of those under six months and older children—the food. The younger class, then, must escape, because a greater majority of them are naturally nourished. Statistics‡ prove with increasing testimony that *all* artificial feeding is not only unnatural but hazardous, and to be successful requires the most intelligent attention. However, if all mothers and nurses could learn that milk exposed to foul or warm air for any length of time may not only sour, but become the vehicle of a virulent poison, perhaps the summer months would bear a better health record.*

One word of warning may not be amiss.‖ Whenever a young child is fed upon cow's milk, and this causes symptoms of disagreement, the diet should be changed at once either to meat or rice; for, if the chief mischief-maker be at work, the best milk will only furnish it with the medium in which it flourishes, and, deprived of this, it will inevitably perish.

* "Philadelphia Medical News," vol. l, p. 676.

† Prof. Vaughan's address before the New York Academy of Medicine, May, 1888. "Philadelphia Medical News," June, 1888.

‡ "Of 591 cases in Liverpool only 28 had natural nourishment; of 341 in Leicester, only two per cent" ("Philadelphia Medical News," June, 1887).

* "Nine tenths of the mortality under one year of age is from preventable causes" (Dr. Wood's address before the American Medical Association).

‖ "Sanitarian," vol. xvii, pp. 308–311.

IS CHRISTIAN SCIENCE A "CRAZE"?

By JOSHUA F. BAILEY.

THE impression is quite general that Christian Science is merely a captivating theory; that its text-book, "Science and Health," is a collection of ingenious opinions—relating mainly to the cure of physical disease by imaginative means—that appeal especially "to persons of a highly religious and highly emotional nature." It is also confounded with "faith-cure" and "mind-cure," and alleged abuses and malpractice occurring under these and other irregular forms of mental healing are heralded as "another Christian Science case." It is credited with contemning observation and induction, and, by consequence, natural science; with making man "a part of God," and with various fanciful pretensions about sickness and death, and the unreality of matter.

A writer in the April "Popular Science Monthly" succeeded in committing all these errors and offenses against exactness of statement—besides others that space forbids the enumeration of—in less than four pages of the "Monthly." After having in this small compass misstated the doctrines and pretensions of the true school of Mind-healing, demolished his own misstatements, and all the false systems as well, this writer, with a strange disregard of sequence, devotes six pages to argument and instance in favor of mental healing, and—most surprising of all—administers what Christian scientists consider a well-merited rebuke to the M. D.s for not giving the public the benefits of this "pleasant and inexpensive medicine that cures in some cases where drugs fail," "shortens the term of sickness and lightens its pains in many other cases," and, "furthermore, has no injurious incidental effects."

There is really no excuse for such misrepresentation of Christian Science; for it has a text-book, "Science and Health," universally recognized as the exponent of its doctrines and methods. When called in question, it is entitled to be judged on authorized statements, and not on those of speculators in public credulity, on newspaper gossip and public rumor. This text-book says: "Systems of so-called 'mind-cure' are as truly material as the prevailing systems of medicine. They have no relationship with Christian Science"; and of "faith-cure," "Faith is belief, and not understanding. Belief is virtually blindness when it admits truth without understanding it. If truth is admitted, but not understood, it may be lost, and error may enter through this same channel of ignorant belief."

So far from not trusting observation and induction, "Science and Health" is a record of experiments in Mind that satisfy the

most exacting rules for the use of these guides in investigation, and that extend over many years. Its statements are absolute and demonstrable in the same sense and by the same methods as the propositions of geometry. Every line of this book was written from demonstration, by which is meant experiment in the sense the word carries in natural science. The author first worked out the principles of healing in Christian Science on herself, after she had been condemned by medical science. Then, through nine years more, she worked out the rule of the operation of truth in the constant, public practice of healing "all manner of diseases," physical and moral.

This practice covered thousands of cases. Her history through these years, and the almost twenty that have succeeded them, has been one of silent endurance, in reliance on God, of mockery and persecution, often—in the earlier times—of hunger and cold. Suffering worse than martyrdom, daily repeated, has set its seal upon her work.

Here is her own declaration as to the method pursued in working out her discovery:

"The point to be determined is, Shall Science explain all cause and effect, or shall these be left open to mere speculative thought? . . . In Christian Science mere opinion is valueless. Proof is essential to a due estimate of the subject. . . . I have set forth Christian Science, and its application to the treatment of disease, only as I have discovered them. I have demonstrated the effects of Truth on the health, longevity, and morals of men through Mind. . . . I have healed hopeless disease, and raised the dying to life and health, through the understanding of God as the only life. . . . The sick, the halt, and the blind look up to me with blessings."

To the truthfulness of *the most surprising of her declarations* many certificates are published in "Science and Health" from persons of unquestioned character, and have stood fourteen years unchallenged. Hundreds of others have been published during the seven years past, and the publication continues monthly in the "Christian Science Journal," with the names and addresses of writers, and thousands more are at the free disposition of any inquirer for truth.

The laws or formulæ of Christian Science are given in "Science and Health" so plainly that any person of average intelligence can repeat the results obtained by the author. These results have been and are being repeated by multitudes of persons, who testify publicly to the fact that they have proved them to be invariable.

Prima facie, then, the pretensions of Christian Science are not absurd. They are entitled to fair and candid examination, conducted as it would be in the case of any other alleged science,

under its own canons of procedure, subject to the laws of observation and induction that govern all investigation. The validity of its conclusions must be allowed to rest on the proofs of conformity to these scientific tests.

The charge that Christian Science contemns natural science is as unfounded as that it disregards observation and induction. It is said in "Science and Health":

> Learning is useful if it is of the right sort. History, observation, invention, philosophic research, and original thought, are essential to the growth of mortal mind out of itself, error. The tangled barbarism of learning we deplore—the mere dogma, the speculative theory, the nauseous fiction.
>
> If natural science says one thing more clearly than another, it is this: that law is everywhere, and that there can be no exception to it. Natural science denies miracles, if by a miracle is meant any variation from the regular order of divine cause and effect.
>
> Herein Christian Science is in a line with natural science. Christian Science devoutly believes the wonderful works performed by Jesus, but affirms that his so-called miracles were in accord with the highest law; that they proceeded from the divine Principle of him, which is the Christ or anointed imperial humanity. Miracles are impossible in Science. The highest manifestation of Life or Truth is divine—not supernatural or preternatural, since Science is nature explicated.

The rational claims of natural science against the authority and mere belief of dogmatic theology have all been anticipated and formulated in "Science and Health." The comparison of "The Devil-Theory," in the editor's table of the April "Monthly," with the following passage from the chapter "Imposition and Demonstration," will illustrate this identity of attitude:

> God, or good, has not created a mind susceptible of creating evil, for evil is the opposing error, and not the truth of creation.
>
> As I understand it, the only evil, or devil, in the universe is made up of such erroneous beliefs as these: that man is a compound of both mind and matter; that a wicked mind can exist in a material form, and both form and mind can be created by the Divine Mind; that God is the author of sin, sickness, and death; and that Mind can be an entity within the cranium, with power to sin *ad libitum*. In other words, Satan is not a person but an illusion. A lie is the only Satan there is, as results prove. All the discords of earth are lies, and falsehood can not proceed from Truth. In and of itself discord is a falsity. It does not represent the fact relative to God or man.

To give the merest outline of the Principle and rule of Christian Science, as laid down in "Science and Health," would require a volume. Some of the phenomena and workings of human consciousness, and conclusions from the standpoint of Christian Science, can only be briefly referred to in the space at command.

Man may be defined as a state of consciousness, and the condition of consciousness constitutes the individuality. Consciousness is related to two distinct classes of phenomena. One of these

classes embraces the impressions derived from or received through the five personal senses, and constitutes what is called material or physical life. These are all summarized in the word *matter*. In the technology of Christian Science they are termed "beliefs" of matter, and are treated as inhering in a supposed subject termed "mortal man" or "mortal mind," and are said to be cognized through material sense. This is the consciousness of life in matter, or life in the material body, and in Christian Science is termed the "false consciousness."

Besides this consciousness or sense of material life, or life in the body, there is another sense or consciousness of Truth, Love, beauty, expressed in the word God, or Spirit. The impressions of Spirit not only do not come to us through the personal senses, can not be cognized by material sense, but they are contrary to this sense, are the opposites of the phenomena of material sense. They are distinct or obscure, just as the individual is immersed in or withdrawn from the objects of material sense, and the impressions derived from them.

Because these two states of consciousness are opposites, they are destructive of one another: as one is increased, the other is diminished; they are precisely represented in the action of light and darkness—as one advances, the other recedes. Every human individuality is the battle-ground of these opposing forces; the scale is at every instant inclined more strongly to the one or the other, and the true history of the individual and of the race—the only history—is the record of this struggle.

In the uninstructed consciousness, and on this mortal plane of existence, the beliefs and fears that are the inseparable concomitants of material sense, or the belief of life in matter, predominate; beliefs of good or ill are connected with all the elemental and other conditions that make up the material environment; with every act of the material man; with every article of food, drink, or apparel; with the function and operation of every organ of the body; with sleep and wakefulness, and every condition that can be named. In their train is the countless array of disease, envy, jealousy, malice, hatred, covetousness; every condition of thought that lust, appetite, and the nameless brood that develop and are propagated as earthly life advances—these are the shadowy attendants that haunt the consciousness of material man—the penalty attached to the false sense of life in matter.

Does progress in wisdom, gained from personal sense, emancipate man from this terrible thralldom? To the contrary, the more knowledge he gains, relative to these conditions and influences, the more laws he finds himself subject to—a subjection that the savage, untutored man is free from. In the words of "Science and Health," "Man hath sought out many inventions, but he

hath not yet found that knowledge can save him from the dire effects of knowledge."

The character of this personal or material sense or so-called consciousness, and the doctrine of Science concerning it, are stated in these graphic words from the text-book of Science:

Personal sense defrauds, lies, cheats, will break all the commands of the Mosaic Decalogue, to meet its own demands. How, then, can this sense be the channel of blessings or of understanding to man? How can man, reflecting God, be dependent on such material senses for knowing, hearing, seeing? Who dare say that the senses of man can be at one time the medium for serving sin, and, at another, for communion with God?

An affirmative reply would contradict the Scripture, for "the same fountain sendeth not forth sweet and bitter waters."

The so-called senses of matter are the only source of evil or error. Science shows them to be false; since matter has no sensation, and no organic construction can give it hearing and sight, or make it the medium of Mind.

Outside of the material sense of things, all is harmony. A wrong sense—of God, man, and creation—is *nonsense*, or want of sense. Belief would have the material senses sometimes good and sometimes bad.

Science sustains with immortal proof the impossibility of any material sense, and defines these so-called senses as human beliefs, whose testimony can not be true of man or his Maker—of whose reality, or immortality, the senses can take no cognizance. Nerves have no more sensation, apart from what belief bestows upon them, than the fibers of a plant. Mind alone feels, sees, tastes, smells, and hears; therefore these faculties continue when organization is destroyed. Otherwise the very worms could unfashion man. If it were possible for the real senses of man to be injured, Soul could reproduce them in all their perfection; but they can not be disturbed, since they exist in Soul.

"Science and Health" gives plain, practical rules by which the origin and classification of all the objects or images appearing in consciousness can, first, be instantly recognized; and, second, can be dealt with understandingly and on their merits. It thus simply affirms that states and conditions of consciousness can be gradually and progressively controlled and changed from fear and suffering to happiness and serene confidence. It teaches how to eliminate from consciousness, how to destroy all objects that are opposed to harmony, through the cultivated understanding of Truth. The operation of this understanding results in gradual elimination of material sense, and beliefs of matter that are its concomitant, from the individual, and thus from the race, consciousness. The improved state of consciousness thus resulting is what constitutes "Christian Science Mind-healing."

Hundreds of thousands of persons, found in every city, town, and village, are living this Science. They have destroyed, individually, and in the measure of their several understandings of Science, the beliefs and fears of matter, and have come into a state of measurable, relative health and harmony. That all who

enter the Science can not demonstrate on themselves and others with the same or with uniform success, is no more an argument against its Principle and Rule, than is the fact that few can follow the calculations of Leverrier an argument against the existence of the planet Neptune, or the truth of mathematics that pointed it out. Because every school-boy or college graduate does not work his way into the calculus, or reach the demonstration of the highest problem of geometry, shall we deny the exactness and value of mathematics, and throw away our Euclid and the arithmetics? To the contrary of such reasoning, would not the pretension that the results of Christian Science could be brought out arbitrarily, and in disregard of established facts and laws of consciousness, be a demonstration of its unscientific character?

Now, as to the question of reality or unreality of matter and its beliefs, especially of sickness and sin: evidently, if the objects opposed to harmony can be destroyed or kept out of any individual consciousness, such objects will—to this individual—have ceased to exist. If he can keep out any one or a number of such objects, just in so far approach is made to the state of absolute harmony, that is wholeness or health.

Christian Science admits the reality of the phenomena of matter—as defined above—*to material sense*, and it teaches the destruction of this sense, through the operation of Truth understood; but it demonstrates, by such destruction, that it is a false sense, and that it is unreal in this—that it has neither Principle nor permanence.

The exercise of the healing power in Christian Science is no mystery. It is explained in "Science and Health" as follows:

"A mental state of self-condemnation and guilt, or a faltering and doubting trust in Truth, are unsuitable conditions for healing the sick; if lost yourself in the belief and fear of disease, and ignorant of the mental remedy, you fail to use the energies of Mind in your own behalf, you can exercise little or no power for others' help."

"To succeed in healing you must conquer your own beliefs and fears as well as those of your patients, and you must rise daily into higher and holier being; by the spirit of Truth and Love you manifest, you will heal the sick. . . . Science makes no concessions to persons or opinions. One must abide strictly by its rules, or he can not demonstrate its Principle. . . . We approach to God or Life in the ratio of our spirituality and fidelity to Truth; and in that ratio we are able to discern the thoughts of the sick and the sinful that it may heal them."

The power of healing goes up and down with the moral condition of the healer, and this so completely that the Scientist knows

his position and power in Mind, from day to day, with the same certainty and precision that the mariner knows the position of his ship on the ocean.

"Science and Health" describes the operation of Christian healing in these words:

> The body improves under the same truth that improves the mind. Christian Science is sunlight to the body. It invigorates and purifies. It acts as an alterative, neutralizing error with Truth. It changes the secretions, expels humors, dissolves tumors, relaxes rigid muscles, and restores carious bones to soundness. The effects of this Science are to stir the human mind to a change of base whereby it may yield to the Divine Mind.
>
> As when an acid and an alkali meet and ferment, bringing out a third property, so mental and moral fermentation change the material base of man, giving more spirituality to mortal sense, and causing it to depend less on material evidence. The changes that go on in mortal mind serve to reconstruct the body.

Hence the doctrine "Truth is the universal medicine of sin *and* sickness"; both have their origin in error, in ignorance; the antidote to error is Truth, to ignorance is understanding; and the question of reality or unreality is summed up in the words "Sin and sickness have just as much reality as you give them—*and no more.*"

The nature and scope of healing in Christian Science are further set forth in these words:

> No man is healed in sin, or by it, any more than he is morally saved in or by sin. To be every whit whole, he must be better spiritually as well as physically. Lust, hatred, and dishonesty make a man sick; and neither medicine nor mind can physically help him unless they make him better morally, and so deliver him from the destroyer. Body and mind are one. The heat of hatred, inflaming brutal propensities, the indulgence of evil motives and aims, will make any man (who is above the very lowest type of manhood) a hopeless sufferer. They consume the body with the fires of hell!

It will be seen that Christian Science is the Science of Life; its text-book says: "Its anatomy is mental self-knowledge, and consists in the art of dissecting thoughts, in order to discover their quality, quantity, and origin; it teaches when and how to probe the self-inflicted wounds of malice, envy, and hate; how to secure the hallowed influences of unselfishness, philanthropy, spiritual love, and the government of the body, both in health and sickness; its ontology is the nature and essence of all being—Mind, and its essential qualities; and on these primary elements my system of mental healing is based; its pharmacy is moral, and its medicine is intellectual and spiritual for physical healing."

The proposition "all is Mind, there is no matter," is fundamental in Christian Science, but, as above intimated, it is not, as superficial critics allege, a bald denial of the phenomena of material sense. In its methods the truth of this proposition is

demonstrated or proved by the annihilation of the alleged unreality. The affirmation of the absolute supremacy of Mind is not stated as a theory, but is accompanied by plain rules, comprehensible to any fair intelligence, by which this supremacy can be verified in an endless progression. This authority over the supposed conditions of matter was first completely demonstrated by Jesus. It is the Science of the life of Jesus, in its supremacy over matter and its beliefs of sin and sickness, that is set forth in "Science and Health."

No one knows, or can learn, any more of this Science than he has demonstrated—that is, lived. The students of natural science will not find unreasonable the declaration of an humble beginner in this Science, that no one is entitled to sit as a judge on it who has not either gone through with the demonstrations as set forth by its Founder, according to her directions, or until he can show by experience that when the rules of the Science are followed the results are not invariable.

This position was forcibly stated in a review of it that appeared the year following the publication of "Science and Health," as follows: "Why do you assail her for individual opinions and beliefs? That is not the ground she occupies. She declares that what she states is not her own. It is Science left subject to proof, based upon Principle, governed by given rules, the demonstration whereof she leaves for you. It is for you to decide whether it is Science or not: now who can answer that question who doesn't understand Science?"

Enough has been said to show that healing in Christian Science is very different from the fanciful representation given of it by the writer in the April "Monthly." Physical healing is a necessary and useful incident, not a factor, in the scheme of Christian Science. The operation of the healing power is as clearly defined and as tangible in consciousness, just as amenable to law—vastly more so to one reasonably well instructed—as are the phenomena involved in the operation of natural law on the plane of visible effects.

The writer in the April "Monthly" could not tell its readers what Christian Science is, precisely because it *is* Science, and can not be learned or picked up by curiously turning over the leaves of "Science and Health," from odd paragraphs in the daily papers, or from the loose gossip that circulates in the lower atmosphere of human thought.

For the ungenerous and unworthy statements reflecting on the personal character and motives of the founder of Christian Science, these words of hers from the great text-book of Science shall make the only answer:

"In founding this system of ethics and medicine I have labored

for principle, not for personality. Others can not take my place, even if willing to do so. I therefore remain at my post, working for the generations to come, never looking for a present reward."

"I have clung to Truth most closely in the hour of its trial. The weapons of mortal selfishness, envy, ambition, and hatred that have opposed, have often pierced the human heart, but 'none of these things have moved me.' . . . Twenty-two years I have planted and watered 'in labor and travail, working day and night.'"

"Hoping all things, enduring all things—in the spirit of Christ's charity—ready to bless them that curse me, glad to bear consolation to the sorrowing and healing to the sick, I commit these pages to honest seekers for Truth in this age and to posterity."

As to the reflections of the same character on the tens of thousands of devoted students who are laboring to spread the glad tidings she has brought, to alleviate and, finally, to destroy the supposed ills of humanity—real to sense, but not to Truth—they are left to the judgment of those who have followed these few words, so unworthy of their great theme.

It is proper to refer to the declaration of the signs of "decadence" of Christian Science. Its founder began in 1867 with a single student. Since that time she has taught nearly four thousand, the number increasing every year—not to speak of the pressure for admission to her classes of hundreds she is obliged every year to refuse. "Science and Health" had an insignificant sale during the years following its publication in 1875. But this, too, has steadily increased yearly, until it has reached a sale of forty thousand copies. A large proportion of the students from the classes of its author have become healers and teachers, so that, while for obvious reasons no exact statistics of their number can be given, it is certain that some hundreds of thousands are to-day "in" Science—that is, living, according to their several understandings, the "Life that is Spirit." Among those who receive "Science and Health" as a revelation of divine Truth are many of the most gifted and honored men and women not only in this country but in England.

Christian Science is no "craze." The readers of "The Popular Science Monthly" will judge for themselves whether the words of its founder are words of soberness or of delusion. She says: "I have never supposed this century would present the full fruits of Christian Science, or that sin, sickness, and death would not continue for centuries to come; but this I do aver, that, as a result of my teaching, old age and decrepitude will not come so soon—that already health is restored and longevity increased by

it. If such are the present fruits, what may not the harvest be when justice shall be done to this Science?"

Christian Science claims to be the Science of sciences; it takes up without hesitation the challenge, "The true science of mind-cure must explain all the phenomena of mental healing," and voluntarily lays itself under the further obligation to account for all mental and all supposed material phenomena whatever. It is this, and all of this, or it is nothing. *Aut omnis, aut nullus,* is the motto on its shield, is its word to humanity. Though the brow of divine Science is star-encircled, its feet are upon the earth, and health, harmony, and holiness are the gifts it brings to men.

"COWARDLY AGNOSTICISM."*

A WORD WITH PROF. HUXLEY.

By W. H. MALLOCK.

I WELCOME the discussion which, in this review and elsewhere, has been lately revived in earnest as to the issue between positive science and theology. I especially welcome Prof. Huxley's recent contribution to it, to which presently I propose to refer in detail. In that contribution—an article with the title "Agnosticism," which appeared a month or two since in "The Nineteenth Century"—I shall point out things which will probably startle the public, the author himself included, in case he cares to attend to them.

Before going further, however, let me ask and answer this question. If Prof. Huxley should tell us that he does not believe in God, why should we think the statement, as coming from him, worthy of an attention which we certainly should not give it if made by a person less distinguished than himself? The answer to this question is as follows: We should think Prof. Huxley's statement worth considering for two reasons: Firstly, he speaks as a man pre-eminently well acquainted with certain classes of facts. Secondly, he speaks as a man eminent, if not pre-eminent, for the vigor and honesty with which he has faced these facts, and drawn certain conclusions from them. Accordingly, when he sums up for us the main conclusions of science, he speaks not in his own name, but in the name of the physical universe, as modern science has thus far apprehended it; and similarly, when from these conclusions he reasons about religion, the bulk of the argu-

* "The Bishop of Peterborough departed so far from his customary courtesy and self-respect as to speak of 'cowardly agnosticism.'"—Prof. Huxley, "Nineteenth Century," February, 1889, p. 170, and "Popular Science Monthly," April, 1889, p. 751.

ments which he advances against theology are in no way peculiar to himself, or gain any of their strength from his reputation; they are virtually the arguments of the whole non-Christian world. He may possibly have, on some points, views peculiar to himself. He may also have certain peculiar ways of stating them. But it requires no great critical acuteness, it requires only ordinary fairness, to separate those of his utterances which represent facts generally accepted, and arguments generally influential, from those which represent only some peculiarity of his own. Now, all this is true not of Prof. Huxley only. With various qualifications, it is equally true of writers with whom Prof. Huxley is apparently in constant antagonism, and who also exhibit constant antagonism among themselves. I am at this moment thinking of two especially—Mr. Frederic Harrison and Mr. Herbert Spencer. Mr. Harrison, in his capacity of religious teacher, is constantly attacking both Mr. Spencer and Prof. Huxley. Prof. Huxley repays Mr. Harrison's blows with interest; and there are certain questions of a religious and practical character as to which he and Mr. Spencer would be hardly on better terms. But, underneath the several questions they quarrel about, there is a solid substructure of conclusions, methods, and arguments, as to which they all agree—agree in the most absolute way. What this agreement consists in, and what practical bearing, if taken by itself, it must have on our views of life, I shall now try to explain in a brief and unquestionable summary; and in that summary, what the reader will have before him is not the private opinion of these eminent men, but ascertained facts with regard to man and the universe; and the conclusions which, if we have nothing else to assist us, are necessarily drawn from those facts by the necessary operations of the mind. The mention of names, however, has this signal convenience—it will keep the reader convinced that I am not speaking at random, and will supply him with standards by which he can easily test the accuracy and the sufficiency of my assertions.

The case, then, of science, or modern thought, against theological religion or theism, and the Christian religion in particular, substantially is as follows:

In the first place, it is now an established fact that the physical universe, whether it ever had a beginning or no, is, at all events, of an antiquity beyond what the imagination can realize; and also that, whether or no it is limited, its extent is so vast as to be equally unimaginable. Science may not pronounce it absolutely to be either eternal or infinite, but science does say this, that so far as our faculties can carry us they reveal to us no hint of either limit, end, or beginning.

It is further established that the stuff out of which the universe

is made is the same everywhere and follows the same laws—whether at Clapham Common or in the farthest system of stars—and that this has always been so to the remotest of the penetrable abysses of time. It is established yet further that the universe in its present condition has evolved itself out of simpler conditions, solely in virtue of the qualities which still inhere in its elements, and make to-day what it is, just as they have made all yesterdays.

Lastly, in this physical universe science has included man—not alone his body, but his life and his mind also. Every operation of thought, every fact of consciousness, it has shown to be associated in a constant and definite way with the presence and with certain conditions of certain particles of matter, which are shown, in their turn, to be in their last analysis absolutely similar to the matter of gases, plants, or minerals. The demonstration has every appearance of being morally complete. The interval between mud and mind, seemingly so impassable, has been traversed by a series of closely consecutive steps. Mind, which was once thought to have descended into matter, is shown forming itself, and slowly emerging out of it. From forms of life so low that naturalists can hardly decide whether it is right to class them as plants or animals, up to the life that is manifested in saints, heroes, or philosophers, there is no break to be detected in the long process of development. There is no step in the process where science finds any excuse for postulating or even suspecting the presence of any new factor.

And the same holds good of the lowest forms of life, and what Prof. Huxley calls "the common matter of the universe." It is true that experimentalists have been thus far unable to observe the generation of the former out of the latter, but this failure may be accounted for in many ways, and does nothing to weaken the overwhelming evidence of analogy that such generation really does take place or has taken place at some earlier period. "Carbonic acid, water, and ammonia," says Prof. Huxley, "certainly possess no properties but those of ordinary matter. . . . But when they are brought together under certain conditions they give rise to protoplasm; and this protoplasm exhibits the phenomenon of life. I see no breach in this series of steps in molecular complication, and I am unable to understand why the language which is applicable to any one form of the series may not be used to any of the others." *

So much, then, for what modern science teaches us as to the universe and the evolution of man. We will presently consider the ways, sufficiently obvious as they are, in which this seems to conflict with the ideas of all theism and theology. But first for a

* "Lay Sermons, Addresses, and Reviews," pp. 114, 117.

moment let us turn to what it teaches us also with regard to the history and the special claims of Christianity. Approaching Christianity on the side of its alleged history, it establishes the three following points: It shows us first that this alleged history, with the substantial truth of which Christianity stands or falls, contains a number of statements which are demonstrably at variance with fact; secondly, that it contains others which, though very probably true, are entirely misinterpreted through the ignorance of the writers who recorded them; and, thirdly, that though the rest may not be demonstrably false, yet those among them most essential to the Christian doctrine are so monstrously improbable and so utterly unsupported by evidence that we have no more ground for believing in them than we have in the wolf of Romulus.

Such, briefly stated, are the main conclusions of science in so far as they bear on theology and the theologic conception of humanity. Let us now consider exactly what their bearing is. Prof. Huxley distinctly tells us that the knowledge we have reached as to the nature of things in general does not enable us to deduce from it any absolute denial either of the existence of a personal God or of an immortal soul in man, or even of the possibility and the actual occurrence of miracles. On the contrary, he would believe to-morrow in the miraculous history of Christianity if only there were any evidence sufficiently cogent in its favor; and on the authority of Christianity he would believe in God and in man's immortality. Christianity, however, is the only religion in the world whose claims to a miraculous authority are worthy of serious consideration, and science, as we have seen, considers these claims to be unfounded. What follows is this—whether there be a God or no, and whether he has given us immortal souls or no, science declares bluntly that he has never informed us of either fact; and if there is anything to warrant any belief in either, it can be found only in the study of the natural universe. Accordingly, to the natural universe science goes, and we have just seen what it finds there. Part of what it finds bears specially on the theologic conception of God, and part bears specially on the theologic conception of man. With regard to God, to an intelligent creator and ruler, it finds him on every ground to be a baseless and a superfluous hypothesis. In former conditions of knowledge it admits that this was otherwise—that the hypothesis then was not only natural but necessary; for there were many seeming mysteries which could not be explained without it. But now the case has been altogether reversed. One after another these mysteries have been analyzed, not entirely, but to this extent at all events, that the hypothesis of an intelligent creator is not only nowhere necessary, but it generally introduces far more difficulties

than it solves. Thus, though we can not demonstrate that a creator does not exist, we have no grounds whatever for supposing that he does. With regard to man, what science finds is analogous. According to theology, he is a being specially related to God, and his conduct and his destinies have an importance which dwarfs the sum of material things into insignificance. But science exhibits him in a very different light; it shows that in none of the qualities once thought peculiar to him does he differ essentially from other phenomena of the universe. It shows that just as there are no grounds for supposing the existence of a creator, so there are none for supposing the existence of an immortal human soul; while as for man's importance relative to the rest of the universe, it shows that, not only as an individual, but also as a race, he is less than a bubble of foam is when compared with the whole sea. The few thousand years over which history takes us are as nothing when compared with the ages for which the human race has existed. The whole existence of the human race is as nothing when compared with the existence of the earth; and the earth's history is but a second and the earth but a grain of dust in the vast duration and vast magnitude of the All. Nor is this true of the past only, it is true of the future also. As the individual dies, so also will the race die; nor would a million of additional years add anything to its comparative importance. Just as it emerged out of lifeless matter yesterday, so will it sink again into lifeless matter to-morrow. Or, to put the case more briefly still, it is merely one fugitive manifestation of the same matter and force which, always obedient to the same unchanging laws, manifest themselves equally in a dung-heap, in a pig, and in a planet—matter and force which, so far as our faculties can carry us, have existed and will exist everywhere and forever, and which nowhere, so far as our faculties avail to read them, show any sign, as a whole, of meaning, of design, or of intelligence.

It is possible that Prof. Huxley, or some other scientific authority, may be able to find fault with some of my sentences or my expressions, and to show that they are not professionally or professorially accurate. If they care for such trifling criticism they are welcome to the enjoyment of it; but I defy any one to show, putting expression aside and paying attention only to the general meaning of what I have stated, that the foregoing account of what science claims to have established is not substantially true, and is not admitted to be so by any contemporary thinker who opposes science to theism, from Mr. Frederic Harrison to Prof. Huxley himself.

And now let us pass on to something which in itself is merely a matter of words, but which will bring what I have said thus far into the circle of contemporary discussion. The men who are

mainly responsible for having forced the above views on the world, who have unfolded to us the verities of nature and human history, and have felt constrained by these to abandon their old religious convictions—these men and their followers have by common consent agreed, in this country, to call themselves by the name of agnostics. Now there has been much quarreling of late among these agnostics as to what agnosticism—the thing which unites them—is. It must be obvious, however, to every impartial observer, that the differences between them are little more than verbal, and arise from bad writing rather than from different reasoning. Substantially the meaning of one and all of them is the same. Let us take, for instance, the two who are most ostentatiously opposed to each other, and have lately been exhibiting themselves, in this and other reviews, like two terriers each at the other's throat. I need hardly say that I mean Prof. Huxley and Mr. Harrison.

Some writers, Prof. Huxley says, Mr. Harrison among them, have been speaking of agnosticism as if it was a creed or a faith or a philosophy. Prof. Huxley proclaims himself to be "dazed" and "bewildered" by the statements. Agnosticism, he says, is not any one of these things. It is simply—I will give his definition in his own words—

> a method, the essence of which lies in the vigorous application of a single principle. . . . Positively, the principle may be expressed: In matters of the intellect, follow your reason as far as it will take you, without regard to any other consideration. And negatively: In matters of the intellect, do not pretend that conclusions are certain which are not demonstrated or demonstrable. That I take to be the agnostic faith, which if a man keep whole and undefiled, he shall not be ashamed to look the universe in the face, whatever the future may have in store for him.

Now anything worse expressed than this for the purpose of the discussion he is engaged in, or, indeed, for the purpose of conveying his own general meaning, it is hardly possible to imagine. Agnosticism, as generally understood, may, from one point of view, be no doubt rightly described as "a method." But is it a method with no results, or with results that are of no interest? If so, there would be hardly a human being idiot enough to waste a thought upon it. The interest resides in its results, and its results solely, and specially in those results that affect our ideas about religion. Accordingly, when the word agnosticism is now used in discussion, the meaning uppermost in the minds of those who use it is not a method, but the results of a method, in their religious bearings; and the method is of interest only in so far as it leads to these. Agnosticism means, therefore, precisely what Prof. Huxley says it does not mean. It means a creed, it means a faith, it means a religious or irreligious philosophy. And this

is the meaning attributed to it not only by the world at large, but in reality by Prof. Huxley also quite as much as by anybody. I will not lay too much stress on the fact that, in the passage just quoted, having first fiercely declared agnosticism to be nothing but a method, in the very next sentence he himself speaks of it as a "faith." I will pass on to a passage that is far more unambiguous. It is taken from the same essay. It is as follows:

"'Agnosticism [says Mr. Harrison] is a stage in the evolution of religion, an entirely negative stage, the point reached by physicists, a purely mental conclusion, with no relation to things social at all.' I am [says Prof. Huxley] quite dazed by this declaration. Are there then any 'conclusions' that are not 'purely mental'? Is there no relation to things social in 'mental conclusions' which affect men's whole conception of life? . . . 'Agnosticism is a stage in the evolution of religion.' If . . . Mr. Harrison, like most people, means by 'religion' theology, then, in my judgment, agnosticism can be said to be a stage in its evolution only as death may be said to be the final stage in the evolution of life."

Let us consider what this means. It means precisely what every one else has all along been saying, that agnosticism is to all intents and purposes a doctrine, a creed, a faith, or a philosophy, the essence of which is the negation of theologic religion. Now the fundamental propositions of theologic religion are these: There is a personal God, who watches over the lives of men; and there is an immortal soul in man, distinct from the flux of matter. Agnosticism, then, expressed in the briefest terms, amounts to two articles—not of belief, but of disbelief. *I do not believe in any God, personal, intelligent, or with a purpose; or, at least, with any purpose that has any concern with man. I do not believe in any immortal soul, or in any personality or consciousness surviving the dissolution of the body.*

Here I anticipate from many quarters a rebuke which men of science are very fond of administering. I shall be told that agnostics never say "there is no God," and never say "there is no immortal soul." Prof. Huxley is often particularly vehement on this point. He would have us believe that a dogmatic atheist is, in his view, as foolish as a dogmatic theist; and that an agnostic, true to the etymology of his name, is not a man who denies God, but who has no opinion about him. But this—even if true in some dim and remote sense—is for practical purposes a mere piece of solemn quibbling, and is utterly belied by the very men who use it whenever they raise their voices to speak to the world at large. The agnostics, if they shrink from saying that there is no God, at least tell us that there is nothing to suggest that there is one, and much to suggest that there is not. Surely, if they never spoke more strongly than this, for practical purposes this is an absolute denial. Prof. Huxley, for instance, is utterly unable to demonstrate that an evening edition of the "Times" is not printed in

Sirius; but if any action depended on our believing this to be true, he would certainly not hesitate to declare that it was a foolish and fantastic falsehood. Who would think the better of him—who would not think the worse—if in this matter he gravely declared himself to be an agnostic? And precisely the same may be said of him with regard to the existence of God. For all practical purposes he is not in doubt about it. He denies it. I need not, however, content myself with my own reasoning. I find Prof. Huxley himself indorsing every word that I have just uttered. He declares that such questions as are treated of in volumes of divinity "are essentially questions of lunar politics, . . . not worth the attention of men who have work to do in the world": and he cites Hume's advice with regard to such volumes as being "most wise"—"Commit them to the flames, for they can contain nothing but sophistry and illusion."* Quotations of a similar import might be indefinitely multiplied; but it will be enough to add to this the statements quoted already, that agnosticism is to theologic religion what death is to life; and that physiology does but deepen and complete the gloom of the gloomiest motto of paganism—"*Debemur morti.*" If then agnosticism is not an absolute and dogmatic denial of the fundamental propositions of theology, it differs from an absolute and dogmatic denial in a degree that is so trivial as to be, in the words of Prof. Huxley himself, "not worth the attention of men who have work to do in the world." For all practical purposes and according to the real opinion of Prof. Huxley and Mr. Harrison equally, agnosticism is not doubt, is not suspension of judgment; but it is a denial of what "most people mean by religion"—that is to say, the fundamental propositions of theology, so absolute that Prof. Huxley compares it to their death.

And now let us pass on to the next point in our argument, which I will introduce by quoting Prof. Huxley again. This denial of the fundamental propositions of theology "affects," he says, "men's whole conception of life." Let us consider how. By the Christian world, life was thought to be important owing to its connection with some unseen universe, full of interests and issues which were too great for the mind to grasp at present, but in which, for good or evil, we should each of us one day share, taking our place among the awful things of eternity. But at the touch of the agnostic doctrine this unseen universe bursts like a bubble, melts like an empty dream; and all the meaning which it once imparted to life vanishes from its surface like mists from a field at morning. In every sense but one, which is exclusively physical, man is remorselessly cut adrift from the eternal; and whatever importance or interest anything has for any of us, must

* "Lay Sermons, Addresses, and Reviews," p. 125.

be derived altogether from the shifting pains or pleasures which go to make up our momentary span of life, or the life of our race, which in the illimitable history of the All is an incident just as momentary.

Now supposing the importance and interest which life has thus lost can not be replaced in any other way, will life really have suffered any practical change and degradation? To this question our agnostics with one consent say Yes. Prof. Huxley says that if theologic denial leads us to nothing but materialism, "the beauty of a life may be destroyed," and "its energies paralyzed"; * and that no one, not historically blind, "is likely to underrate the importance of the Christian faith as a factor in human history, or to doubt that some substitute genuine enough and worthy enough to replace it will arise." † Mr. Spencer says the same thing with even greater clearness: while, as for Mr. Harrison, it is needless to quote from him; for half of what he has written is an amplification of these statements.

It is admitted, then, that life, in some very practical sense, will be ruined if science, having destroyed theologic religion, can not put, or allow to be put, some other religion in place of it. But we must not content ourselves with this general language. Life will be ruined, we say. Let us consider to what extent and how. There is a good deal in life which obviously will not be touched at all—that is to say, a portion of which is called the moral code. Theft, murder, some forms of lying and dishonesty, and some forms of sexual license, are inconsistent with the welfare of any society; and society, in self-defense, would still condemn and prohibit them, even supposing it had no more religion than a tribe of gibbering monkeys. But the moral code thus retained would consist of prohibitions only, and of such prohibitions only as could be enforced by external sanctions. Since, then, this much would survive the loss of religion, let us consider what would be lost along with it. Mr. Spencer, in general terms, has told us plainly enough. What would be lost, he says, is, in the first place, "our ideas of goodness, rectitude, or duty," or, to use a single word, "morality." This is no contradiction of what has just been said, for morality is not obedience, enforced or even instinctive, to laws which have an external sanction, but an active co-operation with the spirit of such laws, under pressure of a sanction that resides in our own wills. But not only would morality be lost, or this desire to work actively for the social good; there would be lost also every higher conception of what the social good or of what our own good is; and men would, as Mr. Spencer says, "become chiefly absorbed in

* "Lay Sermons, Addresses, and Reviews," p. 127.

† "Agnosticism," "Nineteenth Century," February, 1889, p. 191, and "Popular Science Monthly," April, 1889, p. 773.

the immediate and the relative."* Prof. Huxley admits in effect precisely the same thing when he says that the tendency of systematic materialism is to "paralyze the energies of life," and "to destroy its beauty."

Let us try to put the matter a little more concisely. It is admitted by our agnostics that the most valuable element in our life is our sense of duty, coupled with obedience to its dictates; and this sense of duty derives both its existence and its power over us from religion, and from religion alone. How it derived them from the Christian religion is obvious. The Christian religion prescribed it to us as the voice of God to the soul, appealing as it were to all our most powerful passions—to our fear, to our hope, and to our love. Hope gave it a meaning to us, and love and fear gave it a sanction. The agnostics have got rid of God and the soul together, with the loves, and fears, and hopes by which the two were connected. The problem before them is to discover some other considerations—that is, some other religion—which shall invest duty with the solemn meaning and authority derivable no longer from these. Our agnostics, as we know, declare themselves fully able to solve it. Mr. Spencer and Mr. Harrison, though the solution of each is different, declare not only that some new religion is ready for us, but that it is a religion higher and more efficacious than the old; while Prof. Huxley, though less prophetic and sanguine, rebukes those "who are alarmed lest man's moral nature be debased," and declares that a wise man like Hume would merely "smile at their perplexities."†

Let us now consider what this new religion is—or rather these new religions, for we are offered more than one. So far as form goes, indeed, we are offered several. They can, however, all of them be resolved into two, resting on two entirely different bases, though sometimes, if not usually, offered to our acceptance in combination. One of these, which is called by some of its literary adherents Positivism or the Religion of Humanity, is based on two propositions with regard to the human race. The first proposition is that it is constantly though slowly improving, and will one day reach a condition thoroughly satisfactory to itself. The second proposition is that this remote consummation can be made so interesting to the present and to all intervening generations that they will strain every nerve to bring it about and hasten it. Thus, though humanity is admitted to be absolutely a fleeting phenomenon in the universe, it is presented relatively as of the utmost moment to the individual; and duty is supplied with a constant

* "Since the beginning, religion has had the all-essential office of preventing men from being chiefly absorbed in the relative or the immediate, and of awaking them to a consciousness of something beyond it."—"First Principles," p. 100.

† "Lay Sermons," pp. 123, 124.

meaning by hope, and with a constant motive by sympathy. The basis of the other religion is not only different from this, but opposed to it. Just as this demands that we turn away from the universe, and concentrate our attention upon humanity, so the other demands that we turn away from humanity and concentrate our attention on the universe. Mr. Herbert Spencer calls this the Religion of the Unknowable; and though many agnostics consider the name fantastic, they one and all of them, if they resign the religion of humanity, consider and appeal to this as the only possible alternative.

Now I have already in this review, not many months since, endeavored to show how completely absurd and childish the first of these two religions, the Religion of Humanity, is. I do not propose, therefore, to discuss it further here, but will beg the reader to consider that for the purpose of the present argument it is brushed aside like rubbish, unworthy of a second examination. Perhaps this request will sound somewhat arbitrary and arrogant, but I have something to add which will show that it is neither. The particular views which I now aim at discussing are the views represented by Prof. Huxley; and Prof. Huxley rejects the Religion of Humanity as completely as I do, and with a great deal less ceremony, as the following passage will demonstrate:

> Out of the darkness of prehistoric ages man emerges with the marks of his lowly origin strong upon him. He is a brute, only more intelligent than the other brutes; a blind prey to impulses which, as often as not, lead him to destruction; a victim to endless illusions which, as often as not, make his mental existence a terror and a burden, and fill his physical life with barren toil and battle. He attains a certain degree of physical comfort, and develops a more or less workable theory of life, in such favorable situations as the plains of Mesopotamia or Egypt, and, then, for thousands and thousands of years, struggles with varying fortunes, attended by infinite wickedness, bloodshed, and misery, to maintain himself at this point against the greed and the ambition of his fellow-men. He makes a point of killing or otherwise persecuting all those who try to get him to move on; and when he has moved on a step, foolishly confers post-mortem deification on his victims. He exactly repeats the process with all who want to move a step yet further. And the best men of the best epoch are simply those who make the fewest blunders and commit the fewest sins. . . . I know of no study so unutterably saddening as that of the evolution of humanity as it is set forth in the annals of history; . . . [and] when the positivists order men to worship humanity—that is to say, to adore the generalized conception of men, as they ever have been, and probably ever will be—I must reply that I could just as soon bow down and worship the generalized conception of a "wilderness of apes."*

Let us here pause for a moment and look about us, so as to see where we stand. Up to a certain point the agnostics have all gone together with absolute unanimity, and I conceive myself to have

* "Agnosticism," "Nineteenth Century," February, 1889, pp. 191, 192, and "Popular Science Monthly," April, 1889, pp. 772, 773.

gone with them. They have all been unanimous in their rejection of theology, and in regarding man and the race of men as a fugitive manifestation of the all-enduring something, which always, everywhere, and in an equal degree, is behind all other phenomena of the universe. They are unanimous also in affirming that, in spite of its fugitive character, life can afford us certain considerations and interests, which will still make duty binding on us, will still give it a meaning. At this point, however, they divide into two bands. Some of them assert that the motive and the meaning of duty is to be found in the history of humanity, regarded as a single drama, with a prolonged and glorious conclusion, complete in itself, satisfying in itself, and imparting, by the sacrament of sympathy, its own meaning and grandeur to the individual life, which would else be petty and contemptible. This is what some assert, and this is what others deny. With those who assert it we have now parted company, and are standing alone with those others who deny it—Prof. Huxley among them, as one of their chief spokesmen.

And now addressing myself to Prof. Huxley in this character, let me explain what I shall try to prove to him. If he could believe in God and in the divine authority of Christ, he admits he could account for duty and vindicate a meaning for life; but he refuses to believe, even though for some reasons he might wish to do so, because he holds that the beliefs in question have no evidence to support them. He complains that an English bishop has called this refusal "cowardly"—"has so far departed from his customary courtesy and self-respect as to speak of 'cowardly agnosticism.'" I agree with Prof. Huxley that, on the grounds advanced by the bishop, this epithet "cowardly" is entirely undeserved; but I propose to show him that, if not deserved on them, it is deserved on others, entirely unsuspected by himself. I propose to show that his agnosticism is really cowardly, but cowardly not because it refuses to believe enough, but because, tried by its own standards, it refuses to deny enough. I propose to show that the same method and principle, which is fatal to our faith in the God and the future life of theology, is equally fatal to anything which can give existence a meaning, or which can—to have recourse to Prof. Huxley's own phrases—"prevent our 'energies' from being 'paralyzed,' and 'life's beauty' from being destroyed." I propose, in other words, to show that his agnosticism is cowardly, not because it does not dare to affirm the authority of Christ, but because it does not dare to deny the meaning and the reality of duty. I propose to show that the miserable rags of argument with which he attempts to cover the life which he professes to have stripped naked of superstition, are part and parcel of that very superstition itself—that, though they are not the

chasuble and the embroidered robe of theology, they are its hair-shirt, and its hair-shirt in tatters—utterly useless for the purpose to which it is despairingly applied, and serving only to make the forlorn wearer ridiculous. I propose to show that in retaining this dishonored garment, agnosticism is playing the part of an intellectual Ananias and Sapphira; and that in professing to give up all that it can not demonstrate, it is keeping back part, and the larger part of the price—not, however, from dishonesty, but from a dogged and obstinate cowardice, from a terror of facing the ruin which its own principles have made.

Some, no doubt, will think that this is a rash undertaking, or else that I am merely indulging in the luxury of a little rhetoric. I hope to convince the reader that the undertaking is not rash, and that I mean my expressions to be taken in a frigid and literal sense. Let me begin then by repeating one thing, which I have said before. When I say that agnosticism is fatal to our conception of duty, I do not mean that it is fatal to those broad rules and obligations which are obviously necessary to any civilized society, which are distinctly defensible on obvious utilitarian grounds, and which, speaking generally, can be enforced by external sanctions. These rules and obligations have existed from the earliest ages of social life, and are sure to exist as long as social life exists. But so far are they from giving life a meaning, that on Prof. Huxley's own showing they have barely made life tolerable. A general obedience to them for thousands and thousands of years has left "the evolution of man, as set forth in the annals of history," the "most unutterably saddening study" that Prof. Huxley knows. From the earliest ages to the present—Prof. Huxley admits this—the nature of man has been such that, despite their laws and their knowledge, most men have made themselves miserable by yielding to "greed" and to "ambition," and by practicing "infinite wickedness." They have proscribed their wisest when alive, and accorded them a "foolish" hero-worship when dead. Infinite wickedness, blindness, and idiotic emotion have, then, according to Prof. Huxley's deliberate estimate, marked and marred men from the earliest ages to the present; and he deliberately says also, that "as men ever have been, they probably ever will be."

To do our duty, then, evidently implies a struggle. The impulses usually uppermost in us have to be checked, or chastened, by others, and these other impulses have to be generated, by fixing our attention on considerations which lie somehow beneath the surface. If this were not so, men would always have done their duty; and their history would not have been "unutterably saddening," as Prof. Huxley says it has been. What sort of considerations, then, must those we require be? Before answering

this question let us pause for a moment, and, with Prof. Huxley's help, let us make ourselves quite clear what duty is. I have already shown that it differs from a passive obedience to external laws, in being a voluntary and active obedience to a law that is internal; but its logical aim is analogous—that is to say, the good of the community, ourselves included. Prof. Huxley describes it thus—"to devote one's self to the service of humanity, including intellectual and moral self-culture under that name"; "to pity and help all men to the best of one's ability"; "to be strong and patient," "to be ethically pure and noble"; and to push our devotion to others "to the extremity of self-sacrifice." All these phrases are Prof. Huxley's own. They are plain enough in themselves; but, to make what he means yet plainer, he tells us that the best examples of the duty he has been describing are to be found among Christian martyrs and saints, such as Catherine of Sienna, and above all in the ideal Christ—"the noblest ideal of humanity," he calls it, "which mankind has yet worshiped." Finally, he says that "religion, properly understood, is simply the reverence and love for [this] ethical ideal, and the desire to realize that ideal in life which every man ought to feel." That man "ought" to feel this desire, and "ought" to act on it, "is," he says, "surely indisputable," and "agnosticism has no more to do with it than it has with music or painting."

Here, then, we come to something at last which Prof. Huxley, despite all his doubts, declares to be certain—to a conclusion which agnosticism itself, according to his view, admits to be "indisputable." Agnosticism, however, as he has told us already, lays it down as a "fundamental axiom" that no conclusions are indisputable but such as are "demonstrated or demonstrable." The conclusion, therefore, that we ought to do our duty, and that we ought to experience what Prof. Huxley calls "religion," is evidently a conclusion which, in his opinion, is demonstrated or demonstrable with the utmost clearness and cogency. Before, however, inquiring how far this is the case, we must state the conclusion in somewhat different terms, but still in terms which we have Prof. Huxley's explicit warrant for using. Duty is a thing which men in general, "as they always have been, and probably ever will be," have lamentably failed to do, and to do which is very difficult, going as it does against some of the strongest and most victorious instincts of our nature. Prof. Huxley's conclusion, then, must be expressed thus: "We ought to do something which most of us do not do, and which we can not do without a severe and painful struggle, often involving the extremity of self-sacrifice."

And now, such being the case, let us proceed to this crucial question—What is the meaning of the all-important word "*ought*"?

It does not mean merely that on utilitarian grounds the conduct in question can be defended as tending to certain beneficent results. This conclusion would be indeed barren and useless. It would merely amount to saying that some people would be happier if other people would for their sake consent to be miserable; or that men would be happier as a race if their instincts and impulses were different from "what they always have been and probably ever will be." When we say that certain conduct ought to be followed, we do not mean that its ultimate results can be shown to be beneficial to other people, but that they can be exhibited as desirable to the people to whom the conduct is recommended—and not only as desirable, but as desirable in a pre-eminent degree—desirable beyond all other results that are immediately beneficial to themselves. Now the positivists, or any other believers in the destinies of humanity, absurd as their beliefs may be, still have in their beliefs a means by which, theoretically, duty could be thus recommended. According to them, our sympathy with others is so keen, and the future in store for our descendants is so satisfying, that we have only to think of this future and we shall burn with a desire to work for it. But Prof. Huxley, and those who agree with him, utterly reject both of these suppositions. They say, and very rightly, that our sympathies are limited; and that the blissful future, which it is supposed will appeal to them, is moonshine. The utmost, then, in the way of objective results, that any of us can accomplish by following the path of duty, is not only little in itself, but there is no reason for supposing that it will contribute to anything great. On the contrary, it will only contribute to something which, as a whole, is "unutterably saddening."

Let us suppose, then, an individual with two ways of life open to him—the way of ordinary self-indulgence, and the way of pain, effort, and self-sacrifice. The first seems to him obviously the most advantageous; but he has heard so much fine talk in favor of the second, that he thinks it at least worth considering. He goes, we will suppose, to Prof. Huxley, and asks to have it demonstrated that this way of pain is preferable. Now what answer to that could Prof. Huxley make—he, or any other agnostic who agrees with him? He has made several answers. I am going to take them one by one; and while doing to each of them, as I hope, complete justice, to show that they are not only absolutely and ridiculously impotent to prove what is demanded of them, but they do not even succeed in touching the question at issue.

One of the answers hardly needs considering, except to show to what straits the thinker must be put who uses it. A man, says Prof. Huxley, ought to choose the way of pain and duty, because it conduces in some small degree to the good of others; and to do

good to others ought to be his predominant desire, or, in other words, his religion. But the very fact in human nature that makes the question at issue worth arguing, is the fact that men naturally do not desire the good of others, or, at least, desire it in a very lukewarm way; and every consideration which the positivist school advance to make the good of others attractive and interesting to ourselves Prof. Huxley dismisses with what we may call an uproarious contempt. If, then, we are not likely to be nerved to our duty by a belief that duty done tends to produce and hasten a change that shall really make the whole human lot beautiful, we are not likely to be nerved to it by the belief that its utmost possible result will be some partial and momentary benefit to a portion of "a wilderness of apes." The positivist says to the men of the present day: "Work hard at the foundation of things social; for on these foundations one day will arise a glorious edifice." Prof. Huxley tells them to work equally hard, only he adds that the foundation will never support anything better than pig-sties. His attempt, then, on social grounds, to make duty binding, and give force to the moral imperative, is merely a fragment of Mr. Harrison's system, divorced from anything that gave it a theoretical meaning. Prof. Huxley has shattered that system against the hard rock of reality, and this is one of the pieces which he has picked up out of the mire.

The social argument, then, we may therefore put aside, as good perhaps for showing what duty is, but utterly useless for creating any desire to do it. Indeed, to render Prof. Huxley justice, it is not the argument on which he mainly relies. The argument, or rather the arguments, on which he mainly relies have no direct connection with things social at all. They seek to create a religion, or to give a meaning to duty, by dwelling on man's connection, not with his fellow-men, but with the universe, and thus developing in the individual a certain ethical self-reverence, or rather, perhaps, preserving his existing self-reverence from destruction. How any human being who pretends to accurate thinking can conceive that these arguments would have the effect desired —that they would either tend in any way to develop self-reverence of any kind, or that this self-reverence, if developed, could connect itself with practical duty—passes my comprehension. Influential and eminent men, however, declare that such is their opinion; and for that reason the arguments are worth analyzing. Mr. Herbert Spencer is here in almost exact accord with Prof. Huxley; we will therefore begin by referring to his way of stating the matter.

"We are obliged," he says, "to regard every phenomenon as a manifestation of some power by which we are acted on; though omnipresence is unthinkable, yet, as experience discloses no bounds

to the diffusion of phenomena, we are unable to think of limits to the presence of this power; while the criticisms of science teach us that this power is incomprehensible. And this consciousness of an incomprehensible power, called omnipresent from inability to assign its limits, is just that consciousness on which religion dwells." * Now Prof. Huxley, it will be remembered, gives an account of religion quite different. He says it is a desire to realize a certain ideal in life. His terminology therefore differs from that of Mr. Spencer; but of the present matter, as the following quotation will show, his view is substantially the same.

"Let us suppose," he says, "that knowledge is absolute, and not relative, and therefore that our conception of matter represents that which really is. Let us suppose further that we do know more of cause and effect than a certain succession; and I for my part do not see what escape there is from utter materialism and necessarianism." And this materialism, were it really what science forces on us, he admits would amply justify the darkest fears that are entertained of it. It would "drown man's soul," "impede his freedom," "paralyze his energies," "debase his moral nature," and "destroy the beauty of his life." † But, Prof. Huxley assures us, these dark fears are groundless. There is indeed only one avenue of escape from them; but that avenue truth open to us.

"For," he says, "after all, what do we know of this terrible 'matter,' except as a name for the unknown and hypothetical cause of states of our own consciousness? And what do we know of that 'spirit' over whose extinction by matter a great lamentation is arising, . . . except that it also is a name for an unknown and hypothetical cause or condition of states of consciousness? . . . And what is the dire necessity and iron law under which men groan? Truly, most gratuitously invented bugbears. I suppose if there be an 'iron' law it is that of gravitation; and if there be a physical necessity it is that a stone unsupported must fall to the ground. But what is all we really know and can know about the latter phenomena? Simply that in all human experience stones have fallen to the ground under these conditions; that we have not the smallest reason for believing that any stone so circumstanced will not fall to the ground; and that we have, on the contrary, every reason to believe that it will so fall. . . . But when, as commonly happens, we change *will* into *must*, we introduce an idea of necessity which . . . has no warranty that I can discover anywhere. . . . Force I know, and Law I know; but who is this Necessity, save an empty shadow of my own mind's throwing?"

Let us now compare the statements of these two writers. Each states that the reality of the universe is unknowable; that just as surely as matter is always one aspect of mind, so mind is equally one aspect of matter; and that if it is true to say that the thoughts of man are material, it is equally true to say that the earth from

* "First Principles," p. 99.

† "Lay Sermons," pp. 122, 123, 127.

which man is taken is spiritual. Further, from these statements each writer deduces a similar moral. The only difference between them is, that Mr. Spencer puts it positively, and Prof. Huxley negatively. Mr. Spencer says that a consciousness of the unknowable nature of the universe fills the mind with religious emotion. Prof. Huxley says that the same consciousness will preserve from destruction the emotion that already exists in it. We will examine the positive and negative propositions in order, and see what bearing, if any, they have on practical life.

Mr. Spencer connects his religion with practical life thus: The mystery and the immensity of the All, and our own inseparable connection with it, deepen and solemnize our own conception of ourselves. They make us regard ourselves as "elements in that great evolution of which the beginning and the end are beyond our knowledge or conception"; and in especial they make us so regard our "own innermost convictions."

"It is not for nothing," says Mr. Spencer, "that a man has in him these sympathies with some principles, and repugnance to others. . . . He is a descendant of the past; he is a parent of the future; and his thoughts are as children born to him, which he may not carelessly let die. He, like every other man, may properly consider himself as one of the myriad agencies through whom works the Unknown Cause: and when the Unknown Cause produces in him a certain belief, he is thereby authorized to profess and act with this belief."*

In all the annals of intellectual self-deception it would be hard to find anything to outdo or even to approach this. What a man does or thinks, what he professes or acts out, can have no effect whatever, conceivable to ourselves, beyond such effects as it produces within the limits of this planet; and hardly any effect, worth our consideration, beyond such as it produces on himself and a few of his fellow-men. Now, how can any of these effects be connected with the evolution of the universe in such a way as to enable a consciousness of the universe to inform us that one set of effects should be aimed at by us rather than another? The positivists say that our aim should be the progress of man; and that, as I have said, forms a standard of duty, though it may not supply a motive. But what has the universe to do with the progress of man? Does it know anything about, it or care anything about it? Judging from the language of Mr. Spencer and Prof. Huxley, one would certainly suppose that it did. Surely, in that case, here is anthropomorphism with a vengeance. "It is not for nothing," says Mr. Spencer, "that the Unknowable has implanted in a man certain impulses." What is this but the old theologic doctrine of design? Can anything be more inconsistent with the entire theory of the evolutionist? Mr. Spencer's argu-

* "First Principles," p. 123.

ment means, if it means anything, that the Unknowable has implanted in us one set of sympathies in a sense in which it has not implanted others: else the impulse to deny one's belief, and not to act on it, which many people experience, would be authorized by the Unknowable as much as the impulse to profess it, and to act on it. And according to Mr. Spencer's entire theory, according to Prof. Huxley's entire theory, according to the entire theory of modern science, it is precisely this that is the case. If it is the fact that the Unknowable works through any of our actions, it works through all alike, bad, good, and indifferent, through our lies as well as through our truth-telling, through our injuries to our race as well as through our benefits to it. The attempt to connect the well-being of humanity with any general tendency observable in the universe, is in fact, on agnostic principles, as hopeless as an attempt to get, in a balloon, to Jupiter. It is utterly unfit for serious men to talk about; and its proper place, if anywhere, would be in one of Jules Verne's story-books. The destinies of mankind, so far as we have any means of knowing, have as little to do with the course of the Unknowable as a whole, as the destinies of an ant-hill in South Australia have to do with the question of home rule for Ireland.

Or even supposing the Unknowable to have any feeling in the matter, how do we know that its feeling would be in our favor, and that it would not be gratified by the calamities of humanity, rather than by its improvement? Or here is a question which is more important still. Supposing the Unknowable did desire our improvement, but we, as Prof. Huxley says of us, were obstinately bent against being improved, what could the Unknowable do to us for thus thwarting its wishes?

And this leads us to another aspect of the matter. If consciousness of the Unknowable does not directly influence action, it may yet be said that the contemplation of the universe as the wonderful garment of this unspeakable mystery, is calculated to put the mind into a serious and devout condition, which would make it susceptible to the solemn voice of duty. How any devotion so produced could have any connection with duty I confess I am at a loss to see. But I need not dwell on that point, for what I wish to show is this, that contemplation of the Unknowable, from the agnostic's point of view, is not calculated to produce any sense of devoutness at all. Devoutness is made up of three things, fear, love, and wonder; but were the agnostic's thoughts really controlled by his own principles (which they are not) not one of these emotions could the Unknowable possibly excite in him. It need hardly be said that he has no excuse for loving it, for his own first principles forbid him to say that it is lovable, or that it possesses any character, least of all any anthropomorphic character. But

perhaps it is calculated to excite fear or awe in him. This idea is more plausible than the other. The universe as compared with man is a revelation of forces that are infinite, and it may be said that surely these have something awful and impressive in them. There is, however, another side to the question. This universe represents not only infinite forces, but it represents also infinite impotence. So long as we conform ourselves to certain ordinary rules we may behave as we like for anything it can do to us. We may look at it with eyes of adoration, or make faces at it, and blaspheme it, but for all its power it can not move a finger to touch us. Why, then, should a man be in awe of this lubberly All, whose blindness and impotence are at least as remarkable as its power, and from which man is as absolutely safe as a mouse in a hole is from a lion? But there still remains the emotion of wonder to be considered. Is not the universe calculated to excite our wonder? From the agnostic point of view we must certainly say No. The further science reveals to us the constitution of things the feeling borne in on us more and more strongly is this, that it is not wonderful that things happen as they do, but that it would be wonderful if they happened otherwise: while as for the Unknown Cause that is behind what science reveals to us, we can not wonder at that, for we know nothing at all about it, and, if there is any wonder involved in the matter at all, it is nothing but wonder at our own ignorance.

So much, then, for our mere emotions toward the Unknowable. There still remains, however, one way more in which it is alleged that our consciousness of it can be definitely connected with duty; and this is the way which our agnostic philosophers most commonly have in view, and to which they allude most frequently. I allude to the search after scientific truth and the proclamation of it, regardless of consequences. Whenever the agnostics are pressed as to the consequences of their principles, it is on this conception of duty that they invariably fall back. Mr. Herbert Spencer, on his own behalf, expresses the position thus:

> The highest truth he sees will the wise man fearlessly utter, knowing that, let what may come of it, he is thus playing his right part in the world, knowing that if he can effect the change [in belief] he aims at, well; if not, well also; though not *so* well.*

After what has been said already it will not be necessary to dwell long on this astonishing proposition. A short examination will suffice to show its emptiness. That a certain amount of truth in social intercourse is necessary for the continuance of society, and that a large number of scientific truths are useful in enabling us to add to our material comforts is, as Prof. Huxley would say,

* "First Principles," p. 123.

"surely indisputable." And truth thus understood it is "surely indisputable" that we should cultivate. The reason is obvious. Such truth has certain social consequences, certain things that we all desire come of it; but the highest truth which Mr. Spencer speaks of stands, according to him, on a wholly different basis, and we are to cultivate it, not because of its consequences, but in defiance of them. And what are its consequences, so far as we can see? Prof. Huxley's answer is this: "I have had, and have, the firmest conviction that . . . the *verace via*, the straight road, has led nowhere else but into the dark depths of a wild and tangled forest." Now if this be the case, what possible justification can there be for following this *verace via?* In what sense is the man who follows it playing "his right part in the world"? And when Mr. Spencer says, with regard to his conduct, "it is well," with whom is it well, or in what sense is it well? We can use such language with any warrant or with any meaning only on the supposition that the universe, or the Unknowable as manifested through the universe, is concerned with human happiness in some special way, in which it is not concerned with human misery, and that thus our knowledge of it must somehow make men happier, even though it leads them into a wild and tangled forest. It is certain that our devotion to truth will not benefit the universe; the only question is, will knowledge of the universe, beyond a certain point, benefit us? But the supposition just mentioned is merely theism in disguise. It imputes to the Unknowable design, purpose, and affection. In every way it is contrary to the first principles of agnosticism. Could we admit it, then devotion to truth might have all the meaning that Mr. Spencer claims for it: but if this supposition is denied, as all agnostics deny it, this devotion to truth, seemingly so noble and so unassailable, sinks to a superstition more abject, more meaningless, and more ridiculous than that of any African savage, groveling and mumbling before his fetich.

We have now passed under review the main positive arguments by which our agnostics, while dismissing the existence of God as a question of lunar politics, endeavor to exhibit the reality of religion, and of duty, as a thing that is "surely indisputable." We will now pass on to their negative arguments. While by positive arguments they endeavor to prove that duty and religion are realities, by their negative arguments they endeavor to prove that duty and religion are not impossibilities. We have seen how absolutely worthless to their cause are the former; but if the former are worthless, the latter are positively fatal.

What they are the reader has already seen. I have taken the statement of them from Prof. Huxley, but Mr. Spencer uses language almost precisely similar. These arguments start with two

admissions. Were all our actions linked one to another by mechanical necessity, it is admitted that responsibility and duty would be no longer conceivable. Our "energies," as Prof. Huxley admits, would be "paralyzed" by "utter necessarianism." Further, did our conception of matter represent a reality, were matter low and gross, as we are accustomed to think of it, then man, as the product of matter, would be low and gross also, and heroism and duty would be really successfully degraded, by being reduced to questions of carbon and ammonia. But from all of these difficulties Prof. Huxley professes to extricate us. Let us look back at the arguments by which he considers that he has done so.

We will begin with his method of liberating us from the "iron" law of necessity, and thus giving us back our freedom and moral character. He performs this feat, or rather, he thinks he has performed it, by drawing a distinction between what *will* happen and what *must* happen. On this distinction his entire position is based. Now in every argument used by any sensible man there is probably some meaning. Let us try fairly to see what is the meaning in this. I take it that the idea at the bottom of Prof. Huxley's mind is as follows: Though all our scientific reasoning presupposes the uniformity of the universe, we are unable to assert of the reality behind the universe, that it might not manifest itself in ways by which all present science would be baffled. But what has an idea like this to do with any practical question? So far as man, and man's will, is concerned, we have to do only with the universe as we know it; and the only knowledge we have of it, worth calling knowledge, involves, as Prof. Huxley is constantly telling us, "the great act of faith," which leads us to take what has been as a certain index of what will be. Now, with regard to this universe, Prof. Huxley tells us that the progress of science has always meant, and "means now more than ever," "the extension of the province of . . . causation, and . . . the banishment of spontaneity."* And this applies, as he expressly says, to human thought and action as much as to the flowering of a plant. Just as there can be no voluntary action without volition, so there can be no volition without some preceding cause. Accordingly, if a man's condition at any given moment were completely known, his actions could be predicted with as much or with as little certainty as the fall of a stone could be predicted if released from the hand that held it. Now Prof. Huxley tells us that, with regard to certainty, we are justified in saying that the stone will fall; and we should, therefore, be justified in saying similarly of the man, that he will act in such and such a manner. Whether theoretically we are absolutely certain is no matter. We are absolutely certain for all practical purposes,

* "Lay Sermons," p. 123.

and the question of human freedom is nothing if not practical. What then is gained—is anything gained—is the case in any way altered—by telling ourselves that, though there is certainty in the case, there is no necessity? Suppose I held a loaded pistol to Prof. Huxley's ear, and offered to pull the trigger, should I reconcile him to the operation by telling him that, though it certainly would kill him, there was not the least necessity that it should do so? And with regard to volition and action, as the result of preceding causes, is not the case precisely similar? Let Prof. Huxley turn to all the past actions of humanity. Can he point to any smallest movement of any single human being, which has not been the product of causes, which in their turn have been the product of other causes? Or can he point to any causes which, under given conditions, could have produced any effects other than those they have produced, unless he uses the word *could* in the foolish and fantastic sense which would enable him to say that unsupported stones could possibly fly upward? For all practical purposes the distinction between *must* and *will* is neither more nor less than a feeble and childish sophism. Theoretically no doubt it will bear this meaning—that the Unknowable might have so made man, that at any given moment he could be a different being: but it does nothing to break the force of what all science teaches us—that man, formed as he is, can not act otherwise than as he does. The universe may have no necessity at the back of *it;* but its presence and its past alike are a necessity at the back of *us;* and it is not necessity, but it is doubt of necessity, that is really "the shadow of our own mind's throwing."

And now let us face Prof. Huxley's other argument, which is to save life from degradation by taking away the reproach from matter. If it is true, he tells us, to say that everything, mind included, is matter, it is equally true to say that everything, matter included, is mind; and thus, he argues, the dignity we all attribute to mind, at once is seen to diffuse itself throughout the entire universe. Mr. Herbert Spencer puts the same view thus:

> Such an attitude of mind [contempt for matter and dread of materialism] is significant not so much of a reverence for the Unknown Cause, as of an irreverence for those familiar forms in which the Unknown Cause is manifested to us.* . . . But whoever remembers that the forms of existence of which the uncultivated speak with so much scorn . . . are found to be the more marvelous the more they are investigated, and are also to be found to be in their natures absolutely incomprehensible . . . will see that the course proposed [a reduction of all things to terms of matter] does not imply a degradation of the so-called higher, but an elevation of the so-called lower.

The answer to this argument, so far as it touches any ethical or religious question, is at once obvious and conclusive. The one

* "First Principles," p. 556.

duty of ethics and of religion is to draw a distinction between two states of emotion and two courses of action—to elevate the one and to degrade the other. But the argument we are now considering, though undoubtedly true in itself, has no bearing on this distinction whatever. It is invoked to show that religion and duty remain spiritual in spite of all materialism; but it ends, with unfortunate impartiality, in showing the same thing of vice and of cynical worldliness. If the life of Christ is elevated by being seen in this light, so also is the life of Casanova; and it is as impossible in this way to make the one higher than the other as it is to make one man higher than another by taking them both up in a balloon.

I have now gone through the whole case for duty and for religion, as stated by the agnostic school, and have shown that, as thus stated, there is no case at all. I have shown their arguments to be so shallow, so irrelevant, and so contradictory, that they never could have imposed themselves on the men who condescend to use them, if these men, upon utterly alien grounds, had not pledged themselves to the conclusion which they invoke the arguments to support. Something else, however, still remains to be done. Having seen how agnosticism fails to give a basis to either religion or duty, I will point out to the reader how it actively and mercilessly destroys them. Religion and duty, as has been constantly made evident in the course of the foregoing discussion, are, in the opinion of the agnostics, inseparably connected. Duty is a course of conduct which is more than conformity to human law; religion consists of the emotional reasons for pursuing that conduct. Now these reasons, on the showing of the agnostics themselves, are reasons that do not lie on the surface of the mind. They have to be sought out in moods of devoutness and abstraction, and the more we dwell on them, the stronger they are supposed to become. They lie above and beyond the ordinary things of life; but after communing with them, it is supposed that we shall descend to these things with our purposes sharpened and intensified. It is easy to see, however, if we divest ourselves of all prejudice, and really conceive ourselves to be convinced of nothing which is not demonstrable by the methods of agnostic science, that the more we dwell on the agnostic doctrine of the universe, the less and not the more shall duty seem to be binding on us.

I have said that agnosticism can supply us with no religion. Perhaps I was wrong in saying so, but if we will but invert the supposed tendency of religion, it can and it will supply us with a religion indeed. It will supply us with a religion which, if we describe it in theological language, we may with literal accuracy describe as the religion of the devil—of the devil, the spirit which denies. Instead of telling us of duty, that it has a meaning which

does not lie on the surface, such meaning as may lie on the surface it will utterly take away. It will indeed tell us that the soul which sins shall die; but it will tell us in the same breath that the soul which does not sin shall die the same death. Instead of telling us that we are responsible for our actions, it will tell us that if anything is responsible for them it is the blind and unfathomable universe; and if we are asked to repent of any shameful sins we have committed, it will tell us we might as well be repentant about the structure of the solar system. These meditations, these communings with scientific truth, will be the exact inverse of the religious meditations of the Christian. Every man, no doubt, has two voices—the voice of self-indulgence or indifference, and the voice of effort and duty; but whereas the religion of the Christian enabled him to silence the one, the religion of the agnostic will forever silence the other. I say forever, but I probably ought to correct myself. Could the voice be silenced forever, then there might be peace in the sense in which Roman conquerors gave the name of peace to solitude. But it is more likely that the voice will still continue, together with the longing expressed by it, only to feel the pains of being again and again silenced, or sent back to the soul saying bitterly, I am a lie.

Such, then, is really the result of agnosticism on life, and the result is so obvious to any one who knows how to reason, that it could be hidden from nobody, except by one thing, and that is the cowardice characteristic of all our contemporary agnostics. They dare not face what they have done. They dare not look fixedly at the body of the life which they have pierced.

And now comes the final question to which all that I have thus far urged has been leading. What does theologic religion answer to the principles and to the doctrines of agnosticism? In contemporary discussion the answer is constantly obscured, but it is of the utmost importance that it should be given clearly. It says this: If we start from and are faithful to the agnostic's fundamental principles, that nothing is to be regarded as certain which is not either demonstrated or demonstrable, then the denial of God is the only possible creed for us. To the methods of science nothing in this universe gives any hint of either a God or a purpose. Duty; and holiness, aspiration and love of truth, are "merely shadows of our own mind's throwing," but shadows which, instead of making the reality brighter, only serve to make it more ghastly and hideous. Humanity is a bubble; the human being is a puppet, cursed with the intermittent illusion that he is something more, and roused from this illusion with a pang every time it flatters him. Now, from this condition of things is there no escape? Theologic religion answers, There is one, and one only, and this is the repudiation of the principle on which all agnosticism rests.

Let us see what this repudiation amounts to, and we shall then realize what, in the present day, is the intellectual basis which theologic religion claims. Theologic religion does not say that within limits the agnostic principle is not perfectly valid and has not led to the discovery of a vast body of truth. But what it does say is this: That the truths which are thus discovered are not the only truths which are certainly and surely discoverable. The fundamental principle of agnosticism is that nothing is certainly true but such truths as are demonstrated or demonstrable. The fundamental principle of theologic religion is that there are other truths of which we can be equally or even more certain, and that these are the only truths that give life a meaning and redeem us from the body of death. Agnosticism says nothing is certain which can not be proved by science. Theologic religion says, nothing which is important can be. Agnosticism draws a line round its own province of knowledge, and beyond that it declares is the unknown void which thought can not enter, and in which belief can not support itself. Where Agnosticism pauses, there religion begins. On what seems to science to be unsustaining air, it lays its foundations—it builds up its fabric of certainties. Science regards them as dreams, as an "unsubstantial pageant"; and yet even to science religion can give some account of them. Prof. Huxley says, as we have seen, that "from the nature of ratiocination," it is obvious that it must start "from axioms which can not be demonstrated by ratiocination"; and that in science it must start with "one great act of faith"—faith in the uniformity of nature. Religion replies to science: "And I, too, start with a faith in one thing. I start with a faith which you, too, profess to hold—faith in the meaning of duty and the infinite importance of life; and out of that faith my whole fabric of certainties, one after the other, is reared by the hands of reason. Do you ask for proof? Do you ask for verification? I can give you one only, which you may take or leave, as you choose. Deny the certainties which I declare to be certain—deny the existence of God, deny man's freedom and immortality, and by no other conceivable hypothesis can you vindicate for man's life any possible meaning, or save it from the degradation at which you profess to feel so aghast." "Is there no other way," I can conceive science asking, "no other way by which the dignity of life may be vindicated except this—the abandonment of my one fundamental principle? Must I put my lips, in shame and humiliation, to the cup of faith I have so contemptuously cast away from me? May not this cup pass from me? Is there salvation in no other?" And to this question, without passion or preference, the voice of reason and logic pitilessly answers "No."

Here is the dilemma which men, sooner or later, will see before

them, in all its crudeness and nakedness, cleared from the rags with which the cowardice of contemporary agnosticism has obscured it; and they will then have to choose one alternative or the other. What their choice will be I do not venture to prophesy; but I will venture to call them happy if their choice prove to be this: To admit frankly that their present canon of certainty, true so far as it goes, is only the pettiest part of truth, and that the deepest certainties are those which, if tried by this canon, are illusions. To make this choice a struggle would be required with pride, and with what has long passed for enlightenment; and yet, when it is realized what depends on the struggle, there are some at least who will think that it must end successfully. The only way by which, in the face of science, we can ever logically arrive at a faith in life, is by the commission of what many at present will describe as an intellectual suicide. I do not for a moment admit that such an expression is justifiable, but, if I may use it provisionally, and because it points to the temper at present prevalent, I shall be simply pronouncing the judgment of frigid reason in saying that it is only through the grave and gate of death that the spirit of man can pass to its resurrection.—*Fortnightly Review.*

THE ANIMAL WORLD OF WELL-WATERS.

By Dr. OTTO ZACHARIAS.

"WHAT! can it be that, in the well from which we obtain our drinking-water, there are animals?" This question will undoubtedly suggest itself to one or more of my readers on seeing the heading I have given to these lines. Some of them perhaps may, in view of the existence of a "well-fauna," take a solemn pledge of total abstinence so far as the drinking of water is concerned, and hereafter quench their thirst in something else. Others may perhaps, seemingly in jest, and yet withal in truth, seriously enough ascribe a catarrh of the stomach, contracted by drinking water that was too cold, not to their own carelessness, but to some little animal which they fancy they have swallowed. Others still will play the part of skeptics, and perchance, holding a glass of water from their well up to the light, peer critically into it and exclaim: "The story is merely another fable of the scientists; we shall not believe in the existence of these creatures until we see them."

Nor can any one be blamed for taking this view of the matter. However, right here, the fact should be mentioned that it is not the clear upper portion of the well-water that contains the animal organisms, but that they occur in the lower strata, close to

the bottom of the well and in the mud there. It is especially this mud that must be regarded as the native soil of the different organisms which are to be referred to in the following article; and this at once forcibly calls to our attention the fact that turbid well-water (that is, water which may be suspected of holding mud-particles in suspension) should under no circumstances be used for drinking purposes. Water, clear and sparkling, from a mountain brook, or water drawn from a good well, will, even under a microscope, present nothing that could arouse the aversion of the drinker, or raise doubts as to its desirability from a sanitary point of view.

It is but of late that the attention of naturalists, and especially of zoölogists, has been drawn to the peculiar kinds of animal life which exist in the depths of wells. Credit is due chiefly to Prof. Franz Vejdovsky, in Prague, for calling the attention of scientists to this realm of the animal world. Already many years ago the searching eye of Science had penetrated to the greatest depths of the oceans and inland seas; untiring zeal had discovered interesting phases of animal and plant life in dark caves and grottoes, as well as on the snow-fields of the Alps. But the wells had thus far been left unsearched, and here there still remained a wide field for the explorer, for the making of interesting observations and discoveries.

A peculiar circumstance led to a systematic examination of wells in search for the organisms they might contain. The death-rate at Prague had grown to be very high, and this created in the mind of the public the idea that the condition of the water-supply there was at fault. In 1879 a committee was appointed which was to make a practical investigation into this matter. At the request of this committee, Prof. Vejdovsky has, in a period extending over two years, examined with the microscope the water of more than two hundred wells of the city of Prague, in order to study the noxious organisms suspected of existing therein.

Of course, it is only possible to acquire knowledge of this kind by obtaining a sufficient quantity of mud from the well which is to be examined. This is done by sinking an apparatus especially constructed for the purpose into the well-shaft. The scoop consists of a stirrup made of iron, a foot and a half long and half a foot broad, to which a bag of coarse canvas is attached. This contrivance is fastened to a rope from twenty to thirty metres in length, and, in order that it should sink deep into the mud, a cannon-ball, weighing from eight to ten pounds, is fastened to it at the proper place.

According to the kind of well, the canvas bag is either dragged over the bottom, so that it may gather up the mud, or the rope is jerked up and down; the water is thus stirred up and rendered

turbid, so that in this manner the mud will be caught in the bag on drawing it up to the surface.

In order to make the investigation a thorough one, a small portion of this muddy matter, which generally consists of decaying organic substances, is placed at once under the microscope, and the organisms contained in it are determined. Besides doing this, it is desirable to put a large quantity of the mud, say about one hundred grammes, into a glass jar, which can be closed, and to add some water from the well from which the mud was taken. Then this should be quietly set aside for two or three weeks, in some light spot, where the warm sunbeams can penetrate, so that any eggs or germs present in the water may be destroyed. In this way a great deal may yet be ascertained that could not have been learned at the examination conducted immediately after obtaining the sample.

"But what does the mud from such a well contain?" will be asked by the reader with whom the question what it is that he must guard against is of prime importance. This question is here to be answered. First of all, let a glance be cast at the woodcuts subjoined. Excepting Figs. 6, 7, and 8, the organisms represented are visible only under the microscope, or at least require, in order to be distinguishable, the aid of a powerful magnifying lens. Nearly every particle of well-mud contains the amœbæ pictured in Fig. 1. They resemble drops of flowing liquid, and constantly change their form by sending out ray-like extensions. These extensions of the body are called *pseudopodia*, because their appearance creates the impression that the little animal is possessed of feet. But this is not the case; the pseudopodia (*ps*) are formed only in the moment when a change in location is desired, and they cease to exist when the place is reached which the little animal sought to attain. It can easily be proved that these amœbæ are animals, for they take up solid particles of food, digest the same, and cast out again whatever has not been assimilated. There is no vegetable organism which takes up solid particles into its interior for sustenance. The propagation of the amœba takes place in the simplest manner imaginable, by fission: a large specimen contracts at the center and ultimately divides into two parts, so that the mother-animal is actually rent into halves. In the body-substance of these beings, which are on the lowest plane of organic life, the microscope discloses a number of small particles, and a larger kernel (*k*), which is called the nucleus. Besides this there are yet one or more clear spaces called "vacuoles" (*v*). When fission takes place, the nucleus is also

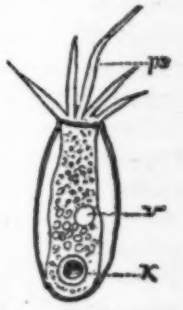


FIG. 1.

divided, and each of the newly formed organisms receives its share. These little beings are particularly entitled to our attention, because each higher organism is also originally evolved from a naked egg-cell, and devoid of any membrane or cuticle.* Moreover, such a cell shows essentially the same simple structure, and moves about in the same manner as the amœba—that is, by the aid of pseudopodia.

Hence the amœbæ are one of the lowest forms of organisms known; they have remained on the lowest plane of development, and, if one accepts, with Lamarck and Darwin, the evolution of the animal world from a simplest beginning, these creatures must be regarded as the original progenitors of all forms of animal life. Of course, every one is at liberty to doubt such progressive evolution of organized beings; but this much is certain, the individual development of each proceeds from a primary state, which is not greatly different from the structure of these amœbæ.

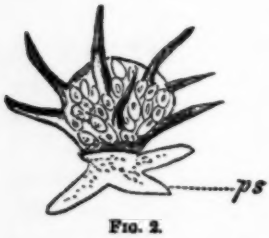


FIG. 2.

Fig. 2 represents a shell-bearing amœba (*Euglypha*), which is also to be found in great numbers in the mud of wells. In this organism the naked sarcode, which consists of a substance similar to albumen, is covered and protected by a membranous envelope, or "carapace," from which, through an opening, the pseudopodia (*ps*) appear. The little organism pictured in Fig. 3 stands in close relationship to the preceding (*Centropyxis aculeata.*) Its shell, made up of diatoms and fragments of small particles of stone, shows thorn-like protuberances.

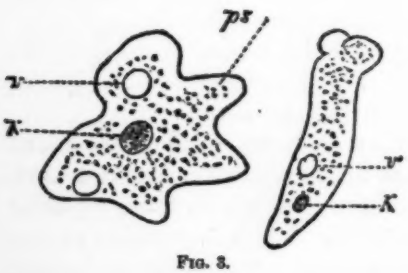


FIG. 3.

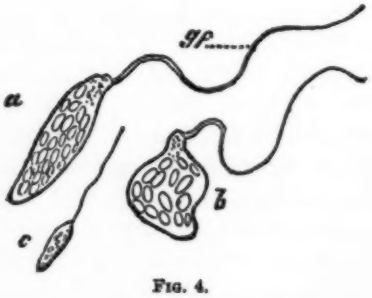


FIG. 4.

Fig. 4 makes us acquainted with the appearance of the flagellate infusoria. These are animals that have a delicate body, which can be contracted, and at one end of which there is a filament (*gf*) which is constantly in motion, and with which certain movements are executed. This filament is in reality nothing else than a long

* Authorities differ on the question as to whether the amœbæ are covered with a membrane or not.—TRANSLATOR.

pseudopodium, which has grown to be permanent, and which has a certain function to exercise, namely, to make motions of rowing and feeling.

Starting with the amœba, the flagellate infusoria represent the next higher phase of morphological differentiation — that is to say, they represent the division of the homogeneous substance of the amœba into distinct parts, to which different functions are assigned. In social science one would allude to this as the commencement of a division of labor.

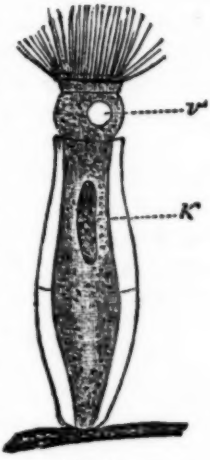


Fig. 5.

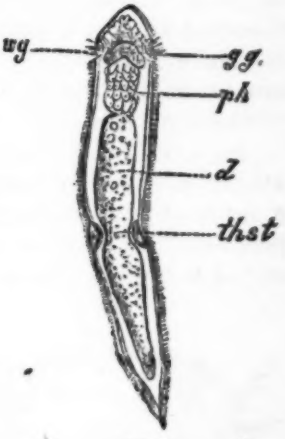


Fig. 6.

Fig. 5 represents an individual belonging to the genus *Cothurnia*, which is very frequently found in the depths of town and country wells. It possesses the power to withdraw with lightning speed into the transparent envelope which surrounds it whenever the cilia which are attached to its front come in contact with anything hard. *K* denotes the nucleus which no infusoria lack, and *v* represents the vacuole, which, however, at times may disappear.

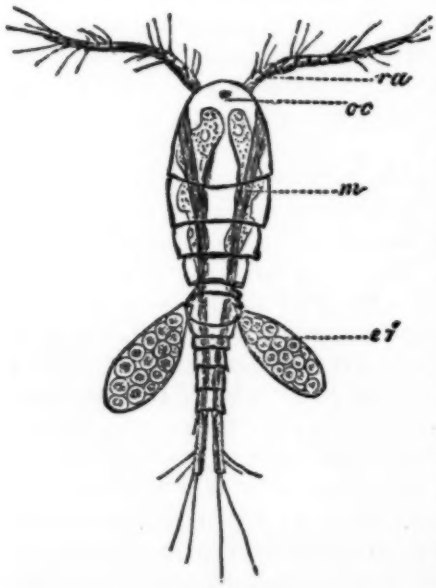


Fig. 7.

Fig. 6 pictures a small creature, the *Stenostonia leucops*, which attains a length of about one millimetre, and which appears to the naked eye like a minute white thread. This kind of worm is of frequent occurrence, and has received its name from the rotary motion which the cilia that are on the surface of its body impart to the water when the animal moves or swims: *g g*, is the nerve-center (brain-ganglion), which is very considerable in proportion to the size of the worm. The mouth is not shown in

the picture, but *p h* is the throat, and this is followed by the sac-like "stomach-intestine," *d*. These worms propagate likewise by simple fission, after a new brain-ganglion has been formed at *th s t*, by the thickening of the two sides. A new mouth is formed by a drawing in of the outer skin. On either side of the head there is a little indentation in which longer hairs are growing. These are probably organs of sense; however, their function has not yet been determined.

Figs. 7 and 8 show a pair of crab-like animals, which are among the regular inhabitants of wells. Fig. 7 is a cyclops; Fig. 8 represents a crustacean, the *Cypris*. The latter is rather a peculiar object, as the animal is inclosed in a shell-like structure, called a carapace, from which only a pair of caudal appendages protrude, which are provided with bristles and serve for the purpose of locomotion; *oc* is the eye.

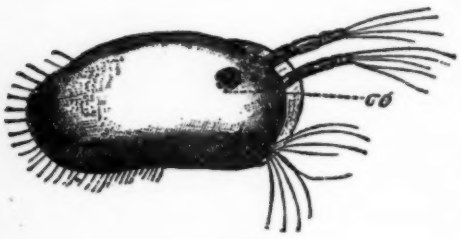


FIG. 8.

A considerable number of species of cyclops are to be found in the mud of wells. Fig. 7 shows the *Cyclops nanus*. This little animal travels rapidly through the water by means of its swimming apparatus, to which the powerful muscles (*m*) lend considerable assistance. The female carries two ovisacs (*ei*) with numerous eggs; *oc*, at the front part of the body, is the eye, which is of a reddish or brown color and possesses a fine lens.

In this article we have enumerated and pictured only the principal representatives of this fauna of the wells, so that a general idea might be gained of the appearance of the animals which live in the turbid water of wells. However, to show how rich in numbers this little animal world is, the fact should be mentioned that Prof. Vejdovsky, after his careful examination of the water of two hundred and thirty-one wells of Prague, was able to announce the existence of—(1) twenty varieties of amœba-like organisms; (2) twelve varieties of flagellate infusoria; (3) forty-five varieties of other infusoria; (4) twenty-four varieties of worms; (5) ten varieties of crustacea—making altogether a total of one hundred and eleven species of organisms. Most of these varieties were found in wells which had been polluted by the infiltration of urine and decaying organic matter. The organisms carried down by the surface water into these lower regions had found abundant food there, and were thus enabled to continue their existence. With regard to the question as to whether the water from wells that show an abundance of these forms of life is dangerous

to health or not, it may be said that the danger of partaking of such water is due, not so much to the presence of the minute infusoria, worms, and crustacea, as to the occurrence of putrefying organic matter which has found its way into these wells and there greatly favors the development of fungi. The intelligent reader will not, therefore, allow the existence of a well-fauna to interfere with his enjoyment in quaffing a cooling draught fresh from the pump; for, as already remarked, the organisms spoken of live only in the lower depths, and as a rule never reach the upper strata of the water.

Should, however, by any accident this normal state of affairs be changed, the turbid appearance of the water would indicate it, and bear at once warning to rather choose water from some other source until the well shall have resumed its normal condition, or shall have been subjected to a thorough cleaning.—*Translated from Ueber Land und Meer for the Popular Science Monthly.*

THE CHINOOK LANGUAGE OR JARGON.

By EDWARD HOLLAND NICOLL.

I WAS about to take a trip up the S——, one of the rivers which flow into Puget Sound. It was early in March, yet the grass was green, the trees were putting out fresh leaves, and the dogwood, salmon-berry, and wild rose were in blossom. The river was swollen by the melting masses of snow on the Cascade Mountains (a prolongation of the Sierra Nevadas), and its waters were rushing rapidly toward the sound. I was considering whether it would be practicable to make headway against the current, when I saw Jack, an Indian, who had been with me on one or two river-journeys, lying lazily in his canoe, enjoying the mild March sun. I went up to him, and our conversation ran thus:

"Klahowya," I said. "Hyas kloshe," replied Jack. "Nika tikegh klatawa kopa chuck; konsi chickamen potlatch?" "Kwinum dollar." "Hyas skookum chuck papet canim?" "Wake hyiu." This is Chinook, and put into English would read: "How do you do?" "Very well." "I want to go up the river." "How much will you give?" "Five dollars." "Will the current make it hard work?" "Not very."

Chinook, a language or jargon, the existence of which few people living east of the Rocky Mountains know of, is the sole medium of communication between the whites and Indians upon the northwest coast of America, from the Columbia River to Alaska, including the tribes scattered over Washington Territory and Oregon. Chinook is a conventional language, and, in this

respect, is like the *lingua franca* of the Mediterranean coast, and the "pidgin" English of the East Indies and China.

A century ago, in the year 1787, two vessels, the Columbia, commanded by John Kendrick, and the Washington, by Robert Gray, left Boston on a voyage to the northwest coast of America, to open up a fur trade, and, if possible, to trade with China. At the rendezvous in Nootka Sound, to the westward of Vancouver Island, which latter is a part of what is now British Columbia, the people on the vessels acquired a number of words used by the natives. The expedition going afterward up the Columbia River to Oregon, they carried these Indian words with them there, which, added to some common and easily pronounced English words, formed the beginning and basis of Chinook. Its vocabulary, however, was scant until the coming of the Astor expedition and the settlement of Astoria. It was then enlarged by numerous English words, together with many of French origin, or of the Canadian *patois*. The dialects of the Chinook and Chehalis tribes, which ranged about southeastern Oregon, furnished many words for its development. The Hudson Bay and Northwest Companies, and the early settlers in Oregon, further added to it; it came into use between Indians of different tribes, and even between Americans and Canadians; it spread to Puget Sound, and found its way, with trade, up the Pacific coast and rivers, as explorers and settlers advanced, gradually spreading until its use reached its present extent.

Chinook is not a written language, and the spelling given here is purely phonetic. Ot the five or six hundred words in common use, about one third are of English and French derivation; a few can not be traced to any source, and the rest are taken from the Chehalis and Chinook dialects.

No words beginning with the letter *r* are used; the sound of that letter is modified into that of *l* or *p*, the pronunciation of which is the easier. This matter of pronunciation, and not the impression made upon the ear, seems in all tongues to be the true foundation of euphony. There are no words in Chinook which begin with the letters *f*, *j*, *q*, *u*, *v*, *x*, or *z*; but two begin with *g*, "get up," and "glease" (grease).

Turning to the words derived from the English, we find "bit," meaning dime, the bit being the general designation on the Pacific coast for a ten-cent piece, and "tea," "sun," "short," "papa," "ole-man," "musket," "smoke," "man," "soap," "paint," "spoon," etc., all of which need no translation. Rice becomes "lice"; fish, "pish"; fire, "piah"; rum, "lum"; rope, "lope"; cry, "cly"; dry, "d'ly." A cat is "puss-puss."

The first white men with whom the Indians in Oregon associated intimately being those of the expedition under Gray and

Kendrick, from Boston, Americans have always been termed in Chinook "Boston men," while "Boston Illahee" ("illahee," the ground, or earth) stands for the "United States." An Englishman is "King George."

With few exceptions, the words of French origin begin with the letter *l*, that is, the article "le" or "la"; there is no article in Chinook except as found joined or prefixed with these French words. The following are some of the most common: "La pome," apple; "la chaise," chair; "la chandelle," candle; "la table"; "la bal," bullet, ball; "la messe," mass; "la pote," door; "la pois," peas; "diaub" (diable), devil; "marsi" (merci), thanks.

It is impossible, without a knowledge of the two dialects, Chinook and Chehalis, to say what native words in the Chinook jargon belong to each; the Chinook, however, predominates.

Many words have two or more equivalents; as, for example, "chickamen," which means iron, any metal, metallic money; with "dollar," it is silver; "chuck" stands for water, river, stream; "salt chuck" is the sea; "skookum chuck," a rapid; "solleks chuck," a rough sea. "Tum-tum" is the heart, will, opinion. "Mamook tum-tum" means to make up one's mind; "mamook kloshe tum-tum," to make friends or peace. "Polaklie" is night, dark, darkness. "Till" means tired, heavy, a weight. "Wau-wau" is to talk, speak, call, ask, tell, answer, conversation; "cultus wau-wau" is idle talk, nonsense.

Onomatopœia is frequent in Chinook. "Hee-hee," means laughter; "Kah-kah," a crow; "moos moos," a cow; "kal-ak-a-la-ma," a goose; "shwahkuk," a frog; all of these are imitations of natural sounds. These words are native, and their origin is due to the disposition to give an imitative complexion to those words which signify matters recognized by the ear, thus bringing about a similarity between the sign and the thing it stands for. But we have to do here with Chinook, not the "bow-wow theory" of the origin of language.

But few of the verbs are English, though many are formed by prefixing "mamook" to make, or do (native), to an English word; as "mamook pent," to paint; "mamook warm," to heat; "mamook bloom" (broom), to sweep; "mamook wash," to wash. It is a curious fact that neither the verb "to be," nor any of its moods or tenses, are found in Chinook. All verbs are understood wherever necessary in a sentence. There are a number of words which are used indifferently as nouns and verbs, though there are but few which are used solely as verbs.

One form of pronoun answers for the personal and possessive. "Nika" is I and mine; "mika," thou and thine; "yahka," he, his; "nesika" is we, us, ours; "mesika," you, yours; "klaska," they, theirs.

The numerals, probably, are taken from the native tongues, and some of them are as follows: 1, "ikt"; 2, "mokst"; 3, "klone"; 4, "lakit"; 5, "kwinum"; 6, "taghum"; 7, "sinnamoket"; 8, "stotekin"; 9, "kwaist"; 10, "tahtlelum"; 11, "tahtlelum pe ikt"; 20, "mokst tahtlelum"; 100, "ikt tukamonuk."

The missionaries who labor among the natives of the northwest coast from necessity learn Chinook. I once attended a church service in Washington Territory, where, the congregation being made up of Indians, the praying and preaching were both in Chinook. The Lord's prayer is rendered thus:

"Nesika papa klaksta mitlite kopa saghalie, kloshe kopa
"Our father who stayeth in the above, good in
nesika tum-tum mika nem; kloshe mika tyee kopa konaway
our heart (be) thy name; good thou chief among all
tillikum; kloshe mika tum-tum kopa illahee, kahkwa kopa
people; good thy will upon earth, as in
saghalie. Potlatch konaway sun nesika muckamuck. Spose
the above. Give every day our food. If
nesika mamook mesachie, wake mika hyas solleks; pe spose
we do ill, (be) not thou very angry; and if
klaksta mesachie kopa nesika, wake nesika solleks kopa
any one (do) evil toward us, (be) not we angry toward
klaska. Mahsh siah kopa nesika konaway mesachie."
them. Send away far from us all evil."

Any one can acquire Chinook whose memory is retentive enough to enable him to learn a certain number of words; and then, with practice, he will speak it fluently. It is not uncommon to hear young children in Washington Territory and Oregon talk in Chinook as easily as in English.

Many Chinook words have taken root in, and form part of, the Pacific coast vernacular. Some of the most common of these are "tillicum," friend; "tyee," chief, or boss; "kiutan," horse; "muckamuck," food; "cultus," worthless; and "siwash," which is always used for Indian. The motto on the seal of Washington Territory is a word used in Chinook, but native in origin, i. e., "Alki," meaning by-and-by, or in the future.

From what has been said, it will be seen that while Chinook does not rise to the dignity of a language, it is an important factor in every-day life as it exists on the northern Pacific coast. The Indians of that region are peculiar. They get their food easily by fishing, hunting, and gathering the wild roots and berries of the woods. Nomadic bodies hang about the towns and settlements, earning money from the whites in various ways. In a word, they procure their living too readily to develop habits of industry and thrift. The experiment of supporting them on Government reservations, and educating them in useful pursuits, is but partially successful. They become discontented, and long for the freedom

of their life on the sea-coast and rivers. The Indian, too, likes to associate with the white man, from whom, it must be confessed, he learns many of the vices, and but few of the virtues, of civilization. It is not probable that Chinook will fall into disuse for many years to come. Though it is difficult to determine whether or not the native population of this part of our country is materially decreasing at present, the race will, no doubt, in time become reduced to small proportions, and the *raison d'être* of Chinook will gradually cease.

SKETCH OF WILLIAM GRAHAM SUMNER.

WILLIAM GRAHAM SUMNER was born at Paterson, N. J., October 30, 1840. He is the son of Thomas Sumner, who came to this country from England in 1836, and married here Sarah Graham, also of English birth. Thomas Sumner was a machinist, who worked at his trade until he was sixty years old, and never had any capital but what he saved out of a mechanic's wages. He was an entirely self-educated man, but always professed great obligations to mechanics' institutes and other associations of the kind of whose opportunities he had made eager use in England. He was a man of the strictest integrity, a total abstainer, of domestic habits, and indefatigable industry. He became enthusiastically interested in total abstinence when a young man in England, the method being that of persuasion and missionary effort. He used to describe his only attempt to make a speech in public, which was on this subject, when he completely failed. He had a great thirst for knowledge, and was thoroughly informed on modern English and American history and on the constitutional law of both countries. He made the education of his children his chief thought, and the only form of public affairs in which he took an active interest was that of schools. His contempt for demagogical arguments and for all the notions of the labor agitators, as well as for the entire gospel of gush, was that of a simple man with sturdy common sense, who had never been trained to entertain any kind of philosophical abstractions. His plan was, if things did not go to suit him, to examine the situation, see what could be done, take a new start, and try again. For instance, inasmuch as the custom in New Jersey was store pay. and he did not like store pay, he moved to New England, where he found that he could get cash. He had decisive influence on the convictions and tastes of the subject of this sketch.

Prof. Sumner grew up at Hartford, Conn., and was educated in the public schools of that city. The High School was then under

the charge of Mr. T. W. T. Curtis, and the classical department under Mr. S. M. Capron. These teachers were equally remarkable, although in different ways, for their excellent influence on the pupils under their care. There was an honesty and candor about both of them which were very healthful in example. They did very little "preaching," but their demeanor was in all respects such as to bear watching with the scrutiny of school-children and only gain by it. Mr. Curtis had great skill in the catechetical method, being able to lead a scholar by a series of questions over the track which must be followed to come to an understanding of the subject under discussion. Mr. Capron united dignity and geniality in a remarkable degree. The consequence was, that he had the most admirable discipline, without the least feeling of the irksomeness of discipline on the part of his pupils. On the contrary, he possessed their tender and respectful affection. Mr. Capron was a man of remarkably few words, and he was a striking example of the power that may go forth from a man by what he is and does in the daily life of a school-room. Both these gentlemen employed in the school-room all the best methods of teaching now so much gloried in, without apparently knowing that they had any peculiar method at all. Prof. Sumner has often declared in public that, as a teacher, he is deeply indebted to the sound traditions which he derived from these two men.

He graduated from Yale College in 1863, and in the summer of that year went to Europe. He spent the winter of 1863–'64 in Geneva, studying French and Hebrew with private instructors. He was at Göttingen for the next two years, studying ancient languages, history, especially church history, and biblical science. In answer to some questions, Prof. Sumner has replied as follows:

"My first interest in political economy came from Harriet Martineau's 'Illustrations of Political Economy.' I came upon these by chance, in the library of the Young Men's Institute at Hartford, when I was thirteen or fourteen years old. I read them all through with the greatest avidity, some of them three or four times. There was very little literature at that time with which these books could connect. My teachers could not help me any, and there were no immediate relations between the topics of these books and any public interests of the time. We supposed then that free trade had sailed out upon the smooth sea, and was to go forward without further difficulty, so that what one learned of the fallacies of protection had only the same interest as what one learns about the fallacies of any old and abandoned error. In college we read and recited Wayland's 'Political Economy,' but I believe that my conceptions of capital, labor, money, and trade, were all formed by those books which I read in my boyhood. In college the interest was turned rather on the po-

litical than on the economic element. It seemed to me then, however, that the war, with the paper money and the high taxation, must certainly bring about immense social changes and social problems, especially making the rich richer and the poor poorer, and leaving behind us the old ante-war period as one of primitive simplicity which could never return. I used to put this notion into college compositions, and laid the foundation in that way for the career which afterward opened to me.

"I enjoyed intensely the two years which I spent at Göttingen. I had the sense of gaining all the time exactly what I wanted. The professors whom I knew there seemed to me bent on seeking a clear and comprehensive conception of the matter under study (what we call 'the truth') without regard to any consequences whatever. I have heard men elsewhere talk about the nobility of that spirit; but the only *body* of men whom I have ever known who really lived by it, sacrificing wealth, political distinction, church preferment, popularity, or anything else for the truth of science, were the professors of biblical science in Germany. That was precisely the range of subjects which in this country was then treated with a reserve in favor of tradition which was prejudicial to everything which a scholar should value. So far as those men infected me with their spirit, they have perhaps added to my usefulness but not to my happiness. They also taught me rigorous and pitiless methods of investigation and deduction. Their analysis was their strong point. Their negative attitude toward the poetic element, their indifference to sentiment, even religious sentiment, was a fault, seeing that they studied the Bible as a religious book and not for philology and history only; but their method of study was nobly scientific, and was worthy to rank, both for its results and its discipline, with the best of the natural science methods. I sometimes wonder whether there is any one else in exactly the same position as I am, having studied biblical science with the Germans, and then later social science, to mark the striking contrast in method between the two. The later social science of Germany is the complete inversion in its method of that of German philology, classical criticism, and biblical science. Its subjection to political exigencies works upon it as disastrously as subjection to dogmatic creeds has worked upon biblical science in this country.

"I went over to Oxford in the spring of 1866. Having given up all my time in Germany to German books, I wanted to read English literature on the same subjects. I expected to find it rich and independent. I found that it consisted of second-hand adaptation of what I had just been studying. I was then quite thoroughly Teutonized, as all our young men are likely to be after a time of study in Germany. I had not undergone the

toning-down process which is necessary to bring a young American back to common sense, and I underrated the real services of many Englishmen to the Bible as a religious book, exactly the supplement which I then needed to my German education. Ullmann's 'Wesen des Christenthums,' which I had read at Göttingen, had steadied my religious faith, and I devoted myself at Oxford to the old Anglican divines and to the standard books of the Anglican communion. The only one of these which gave me any pleasure or profit was Hooker's 'Ecclesiastical Polity.' The first part of this book I studied with the greatest care, making an analysis of it and reviewing it repeatedly. It suited exactly those notions of constitutional order, adjustment of rights, constitutional authority, and historical continuity, in which I had been brought up, and it presented those doctrines of liberty under law applied both to church and state which commanded my enthusiastic acceptance. It also presented Anglicanism in exactly the aspect in which it was attractive to me. It reawakened, however, all my love for political science, which was intensified by reading Buckle and also by another fact next to be mentioned.

"The most singular contrast between Göttingen and Oxford was this: At Göttingen everything one got came from the university, nothing from one's fellow-students. At Oxford it was not possible to get anything of great value from the university; but the education one could get from one's fellows was invaluable. There was a set of young fellows, or men reading for fellowships, there at that time, who were studying Hegel. I became intimate with several of them. Two or three of them have since died at an early age, disappointing hopes of useful careers. I never caught the Hegelian fever. I had heard Lotze at Göttingen, and found his suggestions very convenient to hold on by, at least for the time. We used, however, in our conversations at Oxford, to talk about Buckle and the ideas which he had then set afloat, and the question which occupied us the most was whether there could be a science of society, and, if so, where it should begin and how it should be built. We had all been eager students of what was then called the 'philosophy of history,' and I had also felt great interest in the idea of God in history, with which my companions did not sympathize. We agreed, however, that social science must be an induction from history, that Buckle had started on the right track, and that the thing to do was to study history. The difficulty which arrested us was that we did not see how the mass of matter to be collected and arranged could ever be so mastered that the induction could actually be performed if the notion of an 'induction from history' should be construed strictly. Young as we were, we never took up this crude notion as a real programme of work. I have often thought of it since when I

have seen the propositions of that sort which have been put forward within twenty years. I have lost sight of all my associates at Oxford who are still living. So far as I know, I am the only one of them who has become professionally occupied with social science."

Mr. Sumner returned to the United States in the autumn of 1866, having been elected to a tutorship in Yale College. Of this he says:

"The tutorship was a great advantage to me. I had expected to go to Egypt and Palestine in the next winter, but this gave me an opportunity to study further, and to acquaint myself with church affairs in the United States before a final decision as to a profession. I speedily found that there was no demand at all for 'biblical science'; that everybody was afraid of it, especially if it came with the German label on it. It was a case in which, if a man should work very hard and achieve remarkable results, the only consequence would be that he would ruin himself. At this time I undertook the translation of the volume of Lange's 'Commentary on Second Kings.' While I was tutor I read Herbert Spencer's 'First Principles'—at least, the first part of it—but it made no impression upon me. The second part, as it dealt with evolution, did not then interest me. I also read his 'Social Statics' at that period. As I did not believe in natural rights, or in his 'fundamental principle,' this book had no effect on me."

Mr. Sumner was ordained deacon at New Haven in December, 1867, and priest at New York, July, 1869. He became assistant to Dr. Washburn at Calvary Church, New York, in March, 1869. He was also editor of a broad church paper, which Dr. Washburn and some other clergymen started at this time. In September, 1870, he became rector of the Church of the Redeemer at Morristown, N. J.

"When I came to write sermons, I found to what a degree my interest lay in topics of social science and political economy. There was then no public interest in the currency and only a little in the tariff.* I thought that these were matters of the most urgent importance, which threatened all the interests, moral, social, and economic, of the nation, and I was young enough to believe that they would all be settled in the next four or five years. It was not possible to preach about them, but I got so near to it that I was detected sometimes, as, for instance, when a New Jersey banker came to me, as I came down from the pulpit, and said, 'There was a great deal of political economy in that sermon.'

"It was at this period that I read, in an English magazine, the first of those essays of Herbert Spencer which were afterward collected into the volume 'The Study of Sociology.' These

essays immediately gave me the lead which I wanted to bring into shape the crude notions which had been floating in my head for five or six years, especially since the Oxford days. The conception of society, of social forces, and of the science of society there offered, was just the one which I had been groping after, but had not been able to reduce for myself. It solved the old difficulty about the relation of social science to history, rescued social science from the dominion of the cranks, and offered a definite and magnificent field for work, from which we might hope at last to derive definite results for the solution of social problems.

"It was at this juncture (1872) that I was offered the chair of Political and Social Science at Yale. I had always been very fond of teaching, and knew that the best work I could ever do in the world would be in that profession; also, that I ought to be in an academical career. I had seen two or three cases of men who, in that career, would have achieved distinguished usefulness, but who were wasted in the parish and the pulpit."

Mr. Sumner returned to New Haven as professor in September, 1872. Of the further development of his opinions he says:

"I was definitely converted to evolution by Prof. Marsh's horses some time about 1875 or 1876. I had re-read Spencer's 'Social Statics' and his 'First Principles,' the second part of the latter now absorbing all my attention. I now read all of Darwin, Huxley, Haeckel, and quite a series of the natural scientists. I greatly regretted that I had no education in natural science, especially in biology; but I found that the 'philosophy of history' and the 'principles of philology,' as I had learned them, speedily adjusted themselves to the new conception, and won a new meaning and power from it. As Spencer's 'Principles of Sociology' was now coming out in numbers, I was constantly getting evidence that sociology, if it borrowed the theory of evolution in the first place, would speedily render it back again enriched by new and independent evidence. I formed a class to read Spencer's book in the parts as they came out, and believe that I began to interest men in this important department of study, and to prepare them to follow its development, years before any such attempt was made at any other university in the world. I have followed the growth of the science of sociology in all its branches, and have seen it far surpass all the hope and faith I ever had in it. I have spent an immense amount of work on it, which has been lost because misdirected. The only merit I can claim in that respect is that I have corrected my own mistakes. I have not published them for others to correct."

The above statement of the history of Prof. Sumner's education shows the school of opinion to which he belongs. He adopts

the conception of society according to which it is the seat of forces, and its phenomena are subject to laws, which it is the business of science to investigate. He denies that there is anything arbitrary or accidental in social phenomena, or that there is any field in them for the arbitrary intervention of man. He therefore allows but very limited field for legislation. He holds that men must do with social laws what they do with physical laws—learn them, obey them, and conform to them. Hence he is opposed to state interference and socialism, and he advocates individualism and liberty. He has declared that bimetallism is an absurdity, involving a contradiction of economic laws, and his attacks on protectionism have been directed against it as a philosophy of wealth and prosperity for the nation.

As to politics, he says:

"My only excursion into active politics has been a term as alderman. In 1872 I was one of the voters who watched with interest and hope the movement which led up to the 'Liberal' Convention at Cincinnati, that ended by nominating Greeley and Brown. The platform of that convention was very outspoken in its declarations about the policy to be pursued toward the South. I did not approve of the reconstruction policy. I wanted the South let alone and treated with patience. I lost my vote by moving to New Haven, and was contented to let it go that way. In 1876 I was of the same opinion about the South. If I had been asked what I wanted done, I should have tried to describe just what Mr. Hayes did do after he got in. I therefore voted for Mr. Tilden. In 1880 I did not vote. In 1884 I voted as a Mugwump for Mr. Cleveland. In 1888 I voted for him on the tariff issue."

A distingushed American economist, who is well acquainted with Prof. Sumner's work, has kindly given us the following estimate of his method and of his position and influence as a public teacher: "For exact and comprehensive knowledge Prof. Sumner is entitled to take the first place in the ranks of American economists; and as a teacher he has no superior. His leading mental characteristic he has himself well stated in describing the characteristics of his former teachers at Göttingen; namely, as 'bent on seeking a clear and comprehensive conception of the matter "or truth" under study, without regard to any consequences whatever,' and further, when in his own mind Prof. Sumner is fully satisfied as to what the truth is he has no hesitation in boldly declaring it, on every fitting occasion, without regard to consequences. If the theory is a 'spade,' he calls it a spade, and not an implement of husbandry. Sentimentalists, followers of precedent because it is precedent, and superficial reasoners find little favor, therefore, with Prof. Sumner; and this trait of character has given him a reputation for coldness and lack of what may be

called 'humanitarianism,' and has rendered one of his best essays, 'What Social Classes owe to each other,' almost repulsive in respect to some of its conclusions. At the same time, the representatives of such antagonisms, if they are candid, must admit that Prof. Sumner's logic can only be resisted by making their reason subordinate to sentiment. Prof. Sumner is an earnest advocate of the utmost freedom in respect to all commercial exchanges; and the results of his experiences in the discussion of the relative merits and advantages of the systems of free trade and protection have been such that probably no defender of the latter would now be willing to meet him in a public discussion of these topics."

Prof. Sumner has published "History of American Currency," "Lectures on the History of Protection in the United States," "Life of Andrew Jackson," "Economic Problems," "Protectionism," "Essays in Political and Social Science," and "What Social Classes owe to each other," besides a large number of magazine articles on the same line of subjects.

CORRESPONDENCE.

"CHRISTIAN SCIENCE," "KORESHAN SCIENCE," ETC.

Editor Popular Science Monthly:

AN article appears in your valuable journal for April, page 798, on the subject of "Christian Science." On page 800 an item is given concerning Dr. Teed, of Chicago, in which is stated that said Benedict was a victim of faith-cure, and that C. R. Teed will be called upon to answer criminal charges, etc. I do not know the address of our friend Mr. Fernald, so I can not write him to correct this item. I am personally acquainted with Dr. Teed and the case in question, and I desire to state, in justice to all concerned, that the statement used as an argument by our friend is not true. Dr. Teed is editor of "The Guiding Star." His system of science and philosophy is wholly different in every one of its tenets from "Christian science." He is an eclectic physician, and has had years of practice. He was called to see Mr. Benedict, and gave him medicine. The man died of inflammation of the lungs. Dr. Teed had lately moved from New York to Chicago, and he had not taken out a State license to practice medicine. This was the charge against him. He had a good physician in regular practice in consultation in the case. The man died just as millions of others do. Though both medicine and mind-cure—not "Christian science"—were employed in the case, they both failed. The charges against Dr. Teed were not sustained, and he won the case. I hope you will ask Mr. Fernald to correct this item in his article; at least mail him my statement, and see if he is human enough to undo what he has tried to do—bring reproach on a fine man in fine practice.

Respectfully, R. O. SPEAR.

CITY HOTEL, WAITSBURG, WASHINGTON TER'Y, *April* 1, 1889.

Editor Popular Science Monthly:

As to "Koreshan science" being wholly different from "Christian science," Prof. Spear's authority might seem unquestionable, as he is a graduate of the "Koreshan College," and a writer of "Koreshan" pamphlets. But, to the impartial scientific investigator, this particular hotch-potch of astrology and speculative theology named "Koreshan science" is essentially the same, in whatever *curative action* it may have, as "Christian science," the "faith-cure," and all other varieties of designed or accidental mental healing.

Now to answer the more important part of Prof. Spear's letter. The newspaper report of the Benedict case, from which I quoted, gave more particulars, which I omitted simply to save space. I intended to ask you to print the rest of that report, but I have obtained something better. The physician who was called to see the patient at the last moment has kindly furnished me

the appended account of the matter, which I think will satisfy your readers that I was fully justified in classing this case among the blunders of mental healing.

Very truly yours,

FREDERIK A. FERNALD.

NEW YORK, *May* 8, 1889.

269 CHESTNUT STREET, CHICAGO, *May* 6, 1889.

FREDERIK A. FERNALD, ESQ.

Dear Sir: The man Teed, whom you speak of as doctor, was at the time of Benedict's death the founder and president of the World's College of Life, pastor of the Arch-Triumphant Church, editor of the "Guiding Star," proprietor of a restaurant, etc., all conducted in one or two office-rooms in Central Music Hall. The fellow claimed to be a graduate of the New York Eclectic Medical College, but at the coroner's inquest could not produce a diploma, claiming as an excuse that it was lost. As I remember it, his method consisted in healing by prayer and faith, including absent treatment, all of which was employed in the case of Benedict from the beginning of his illness until about two or three days previous to his death, when medicine was prescribed by an eclectic practitioner whom Teed called to his assistance. At this stage of the case Teed partly or wholly abandoned his system, and also prescribed medicines; but, inasmuch as his knowledge of the pathological conditions which were present, and with which he had to deal, amounted to almost nothing, the treatment was of no avail. According to his statements, made to me the morning of Benedict's death, the patient was regarded as having had diphtheria, pleurisy, intercostal neuralgia, and heart-disease, all existing at one and the same time! The absurdity of such a thing is apparent to almost any one. The *post-mortem* examination proved death to be due to broncho-pneumonia. In my opinion, under proper treatment the case would have recovered. The following is a copy of the verdict of the coroner's jury:

"We, the jury, recommend that one Cyrus R. Teed, who treated and prescribed for the deceased during his sickness without being properly authorized to do so, be held by the proper authorities to the grand jury for violating sections 10, 11, and 12 of an act approved January 16, 1887, regulating the practice of medicine in the State of Illinois; and we furthermore recommend that the penalty for the violation of the above act should be made more severe, so as to include imprisonment in addition to fine, in the future."

In his instructions to the jury the deputy coroner made a few remarks in which he hinted at quacks, impostors, and "voodoo" doctors, and declared that the public was sick of having such frauds running at large.

Respectfully yours,

C. W. LEIGH, M. D.

THE POSITION OF THE AGNOSTIC.

Editor Popular Science Monthly:

WHILE sympathizing heartily with the *spirit* of your editorial article on "Intellectual Liberty," in the May number of the "Monthly," yet it seems to me you have overlooked an application of the word agnostic which it is important that all lovers of truth should recognize. Nay, more, in the words of Nicole, whom you cite with approval, it is "the duty" of the modern thinker to declare himself an "agnostic" in regard to many questions that are still discussed in theological circles.

It is one of the chief merits of the school of philosophy of which Prof. Huxley is so brilliant a member that it distinctly recognizes what Mr. Spencer declares to be "the conviction . . . that has been slowly gaining ground as civilization has advanced," viz., that "human intelligence is incapable of absolute knowledge," and that "our duty is to submit ourselves with all humility to the established limits of our intelligence; and not perversely to rebel against them." Hence, when questions are propounded, to which, *from their nature*, neither an affirmative nor a negative answer can be given, and which do not admit of solution by any natural process, but can only be solved by the acceptance of a supernatural authority—that authority being generally the very question at issue—then it becomes the duty of those who follow the scientific method in their search for truth to declare themselves on all such subjects "agnostics."

Our theological friends occupy much of their time in discussing questions of this character, such as the origin of the universe, the nature and personality of God, the divinity of Christ, the immortality of the soul, and the like. But all these are inscrutable questions, incapable of solution by the human intellect. They have been discussed ever since the dawn of philosophy, and are no nearer solution to-day than when they were first propounded. If settled to any one's satisfaction at all, they can only be so accepted without proof and upon authority. Moreover, there are many questions capable of solution by the scientific method, which theologians discuss only from premises founded upon the supposed solution of the primary questions referred to above. This inevitably prevents their proper discussion and solution. The premises can not be accepted by the scientific thinker who is convinced of the futility of all ontological speculation as a means for establishing the truth. This does not mean—as so many seem to think—that science only concerns itself with those things which can be seen and felt. Nor does it even deny to the individual, who feels that his intellectual and moral integrity can be best conserved by such speculations, the right to indulge in them, and believe in them if needs be. By all means let him do so, if he is made a hap-

pier and a better man by such faith. But let him not upbraid his fellow-man whose faith is not as his is; let him not imagine that truth is entirely on his side; and, above all, let him beware of dogmatism. So "with malice toward none, with charity for all," he may cultivate that openness of mind which a genuine search for truth fosters and intellectual liberty maintains.

I think you will agree with me that much ontological speculation is a distinct loss to sound philosophy, and that there would be a great saving of time and talent if all thinkers accepted and acted upon "the conclusions of Hume and Kant, so well stated by the latter in a sentence" quoted by Prof. Huxley:

"The greatest and perhaps the sole use of all philosophy of pure reason is, after all, merely negative, since it serves, not as an organon for the enlargement (of knowledge), but as a discipline for its delimitation, and, instead of discovering truth, has only the modest merit of preventing error."

ROBERT MATHEWS.

ROCHESTER, N. Y., *May* 8, 1889.

EDITOR'S TABLE.

THE CLAIMS OF "CHRISTIAN SCIENCE."

WE print in this number of the "Monthly" a defense of "Christian science," and an explanation is due our readers for the appearance of such a paper in the pages of a scientific journal. Our April issue contained a carefully prepared article, which aimed to give a just statement of the claims and the results of "Christian science." The writer of that article had good authority for all his statements, and his only purpose was to tell the truth about the new theory. Notwithstanding his efforts in respect to fairness, he is charged, in the reply which we publish, with the most ignorant misrepresentation of the doctrine. We do not concede the truth of this charge, but we print Mr. Bailey's exposition for two reasons: first, to remove all possible ground for the charge of one-sidedness; and, second, to give our readers a fuller idea of what kind of stuff "Christian science" is. Of the half-dozen replies sent us we selected for publication the one that came from the most authoritative source—from the editor of "The Christian Science Journal"—although it was the only one of the whole number which did not explicitly concede the honesty of purpose of Mr. Fernald's article. The reader will observe in the reply frequent quotations from Mrs. Eddy's book, "Science and Health," which, being written by the inventor of the doctrine, is generally accepted as the authoritative expression of the tenets of the sect. Reference to Mr. Fernald's article will show that his statement of the claims of "Christian science" was based upon quotations from exactly the same source, and hence is no more open to the objection of being a "fanciful representation" than is the exposition of Mr. Bailey.

If a doubt remained in the mind of any reader as to whether this doctrine deserves the name of "science," it must be destroyed by Mr. Bailey's article. This writer defines man as "a state of consciousness," comprising, first, the impressions received through the five senses, and, second, "the impressions of Spirit." He asserts that sense-impressions can be kept out of consciousness by these other impressions, and hence that the former are unreal and not to be trusted. This is a good sample of the jumping at conclusions which passes among "Christian scientists" for legitimate induction. The pretension that the senses are "unreal," and that their "testimony can not be true," is too absurd for serious discussion. Nobody who has either any knowledge of science or any plain common sense can accept it—even the "Christian scientists" do not themselves believe it. We venture to say that Mrs. Eddy governs her actions by her sense-impressions a thousand times a day. She would not step off from the

top of her house distrusting the testimony of her eyes that it was a long way to the ground; she would not eat food which her sense of taste told her was unfit to eat; nor remain on a railroad-track when her hearing told her that a train was coming. It is absurdly illogical to trust the senses in such cases, and to refuse to trust them in the precisely parallel cases when they testify to a headache, or the inflammation of a joint, or the presence of a malignant tumor. Our senses are occasionally deceived by close resemblances, but with these exceptions the experience of every day of our lives embraces a countless host of instances in which we find it safe to trust our senses. All the observations which furnish the material of science are made by the senses, and any doctrine which denies the trustworthiness of the senses certainly is not science, whatever else it may be. "Christian science" makes itself ridiculous by strutting about in the borrowed plumage of a system whose data and method it affects to despise. The application of the name of science to this vague metaphysical doctrine is utterly unwarranted. In trade, art, politics, religion, and every other field in which wealth or fame can be achieved, spurious articles are being palmed off continually under the name of something else which enjoys a well-earned repute. Especially has there been of late years an eagerness to tack the name of science on to all sorts of schemes and theories which have no particle of right to the designation, in order that they may share its glory and gain the aid of its prestige.

Mr. Bailey claims that "Christian science" has been vindicated by numerous successes in healing disease. Many persons with various complaints have been subjected to "Christian science" treatment and have ceased to complain. From this he infers not only that the treatment cured them, but also that all these grotesque notions about "the impressions of spirit" and the falsity of the senses must be true. As was shown by the contributor to our April number, it is not necessary to accept the "Christian science" theory in order to explain the process of mental healing. When there is any real effect, it is due to the stimulating influence exerted upon the patient's mind, and it makes no difference whether the stimulus is truth or error, if the patient only is stirred up by it. The alleged results of "Christian science," and the number of its believers, have been paralleled by many delusions which have had their day and then disappeared. Mesmer was a greater prophet in his time than Mrs. Eddy. Mesmerism had its host of cured patients, many of them very worthy persons, who gave enthusiastic testimonials to its efficiency and truth. Spiritualistic healers have paraded their alleged cures, and have argued for their doctrine as persistently as the "Christian scientists," but they have never gained any scientific standing. Every other absurd quackery that bids for the dollars and homage of the ignorant multitude has the same sort of indorsements, but time and science deal mercilessly with all alike. Witchcraft and diabolic agency have been wide-spread and eminently reputable doctrines, but they have ignominiously fallen beneath the attacks of scientific investigators. The reader will find in a note to Dr. White's article in our present issue some of the leading authorities which have combated these myth-making and wonder-mongering agencies. A comparison of one of these books with "Science and Health" will show the difference between a scientific and a visionary treatment of a subject. Mrs. Eddy's book, as shown in the extracts which Mr. Bailey gives, is an incomprehensible, because meaningless, mass of rant and rubbish, consisting of capricious inferences from scanty facts, of far-fetched analogies, of hysterical appeals to sentiment, and fanciful twisting of language. The fact that such a baseless speculation as

"Christian science" can find believers shows that what is referred to in our other editorial as the fancy of the multitude for theories which save them trouble and minister to their love of the marvelous has not yet disappeared from the world. The fascination for holding odd notions seems to be a weakness of the human mind which is hard to eradicate. Such beliefs have been pretty well driven out of chemistry, physics, zoölogy, and other fields of science which can be searchingly investigated, and they remain only in psychology and medicine, dealing with the living human organism, which can not be freely experimented upon. Human credulity has been greatly lessened by the march of scientific enlightenment, and what remains has taken on a new form. In earlier times it delighted in the supernatural, now it revels in its own false ideas of the natural. Then it trusted the revelations of self-appointed prophets, now it pins its faith to the slipshod reasoning of sham investigators. Science has done such wonderful things of late that a certain class of people, including many of excellent judgment in other fields, has come to believe any marvels put forth under its name. Hence we have a modern class of mystery-mongers which will flourish until the spread of scientific culture has diffused the power of discriminating between science and base imitations of science.

DR. ABBOTT'S DEFENSE OF THE DEVIL-THEORY.

Replying to our recent article on "The Devil-Theory," Dr. Lyman Abbott says that he objects to it because it is "unscientific." Will the reverend doctor allow us to say that we object to his article because it is evasive? It is evasive, in the first place, because, though he declares our position to be unscientific, he does not attempt to show in what way, but leaves his readers to discover it for themselves, as he expresses it, "between the lines." It is evasive, in the second place, because it does not attempt to defend the particular version of the devil-theory put forward by the doctor in his "Sunday afternoon" discourse and criticised by us; but, without a word of warning or apology to the reader, cleverly switches that version away and substitutes a completely different one. It will be remembered that the view which Dr. Abbott advocated, in the essay to which we referred, as being most in harmony both with reason and with Scripture was that the victims of devil possession were unhappy creatures who, by a long course of sin, had virtually lost control of themselves and were compelled to act as they might be moved by the malign spirit or spirits to whom they had "voluntarily" surrendered themselves. We pointed out that this was not in harmony with Scripture, which nowhere dropped the slightest hint that the possessed were other than the involuntary and helpless victims of their diabolical persecutors. One would have expected some notice by Dr. Abbott of this direct challenge of the "Scriptural" character of his teaching; but no, not one word have we on this point in his last deliverance in the "Christian Union." We are treated instead to a reproduction of something written by him twenty years ago, which, as he says, expresses perfectly the opinions he holds to-day. What, then, is the drift of the resuscitated article? The reader may judge by a few extracts:

"It may be confidently asserted that, if there are no cases of demonstrable demoniacal possession in modern times, there are mental phenomena which the hypothesis of such possession better solves than any other. What more reasonable explanation has science to afford of the case of that nurse who begged to be dismissed from her mistress's service because, in undressing the child whom she devoutly loved, an almost irresistible passion seized her to tear it to pieces; or that young girl who, otherwise exemplary, seemed to herself to be im-

pelled by a spirit to acts of incendiarism; . . . or that distressed chemist, of a naturally amiable character, who went to an asylum that he might be prevented from indulging in a propensity to kill some one; or that respectable old lady who endeavored to strangle her own daughter?" etc., etc.

But, if these are types of devil possession, what becomes of the theory recently advanced by Dr. Abbott that a devil "never becomes the possessor of a human soul except by its own gradual and voluntary subjection to his hateful despotism"? As an honest man, the doctor will have to admit that the facts marshaled in his article of twenty years ago were destined to support a view *the direct opposite of that which we criticised*—the view, namely, that diabolical agency may be most reasonably assumed when, the general character being sound, some morbid or criminal propensity for which no natural cause can be assigned is manifested in one particular direction. He says he holds the same views now; and yet, the other day, he took up the entirely irreconcilable position that, before the fiend could do anything with a human being, there had to be a "gradual, voluntary" yielding to his infernal suggestions. Dr. Abbott says that he does not "maintain the doctrine of demoniacal possession upon theological grounds"; but surely if he maintained it at all as a sincere, independent conviction, he could hardly put forward two so directly contradictory views without being aware of the contradiction. Will not the doctor say which of the two theories it is he really holds? Is the presence of the devil to be argued from the general excellence of character of those who, in some one respect, are urged by an inexplicable impulse to crime? Or is it the other way—does the fiend simply in the end claim, as it were, his due from those who have "gradually and voluntarily" surrendered themselves into his hands?

Leaving our respected opponent to make his election between the above two views, both of which he singularly professes to maintain, let us, from our own point of view, briefly inquire what light the devil-theory throws either upon the phenomenon of morbid impulses or upon that of hardened, habitual iniquity. If it is a devil who besets an amiable chemist or a respectable old lady, when one or the other wishes to commit some senseless act of violence, the only remedy would seem to be exorcism, which, however, there is reason to fear, is a lost art—outside, at least, of the Roman Catholic Church. But it is perfectly known to Dr. Abbott, as to every one else, that these morbid influences do, more or less, yield to various curative measures in which exorcism has no part whatever. If evidence on this point is wanting it is supplied in the further article we print in our present number from the pen of Dr. Andrew D. White. To know the cause of an evil ought to be a great help to the discovery of a cure, provided the cause is a natural one; but of what assistance would it be to any one to know that his friend or neighbor was afflicted with a devil, if there were no devil-chaser accessible? On the other hand, what mischief might not be wrought by the assumption of a supernatural cause, if the cause were really natural, and therefore, possibly, removable by natural means? We doubt very much whether Dr. Abbott has sufficiently reflected on the mischief he may be doing in encouraging people to believe in devils, instead of urging them to a patient, untiring search after the natural causes and appropriate remedies of all ills, bodily and mental. In this great controversy a man of Dr. Abbott's intelligence ought to be on our side. We would respectfully call upon him to probe his conscience, and ask whether he is really being just to himself, or doing the world a service, by inciting his readers and hearers to attribute to Satanic agency every manifestation of evil that they can not

clearly trace to a natural cause. He knows as well as we do the general inertness of the human mind, and how readily multitudes abandon the search for natural causes in favor of supernatural explanations that, in their eyes, have the double merit of saving them trouble and ministering to their love of the marvelous. Is this a disposition that a man of culture should set himself to aggravate and render more potent for the fabrication of mischievous illusions? That is what Dr. Abbott is now doing, however, and we scarcely understand how he can be blind to the fact.

The other hypothesis—that after a gradual and voluntary subjection of the nature to sin in some form or other the individual passes under the power of a fiend—errs in the direction of superfluity. If Dr. Abbott should elect to stand by this view of the matter, and, in spite of his very recent indorsement, to dismiss his theory of twenty years ago about amiable and respectable people becoming the victims of diabolical possession, we should then only have to ask him how he distinguishes between slavery to a devil and that slavery to evil propensities long indulged which the world has for ages recognized as a familiar and deplorable phenomenon. The devil in this case seems to be a fifth wheel to the coach, and even worse than a fifth wheel; for it is hard to see how the weight of the vehicle is going to be made to rest, in the slightest degree, on so unnecessary an adjunct.

LITERARY NOTICES.

NATURAL INHERITANCE. By FRANCIS GALTON. London and New York: Macmillan & Co. Pp. 259. Price, $2.50.

THE name of the author of this work is identified with studies of problems that lie at the base of the science of heredity, more closely, perhaps, than that of any other who has written upon the subject. Upon it he has published five books and fifteen memoirs and review articles, the earliest of which appeared in 1869. That work, which covered the subject of "Hereditary Genius," could only have been the fruit of long-continued, careful studies, such as Mr. Galton is still pursuing, but under more and more methodized forms. This volume contains the more important of the results of these continued researches, set forth in an orderly way, with more completeness than has hitherto been possible, together with a large amount of new matter. The inquiry relates to the inheritance of moderately exceptional qualities by brotherhoods and multitudes rather than by individuals. Among the problems to be dealt with to which particular attention is called are the one that refers to the curious regularity observed in the statistical peculiarities of populations during a long series of generations, in which certain marks that may not recur prominently in the groups most closely related to one another, appear most distinctly through the whole; the average share contributed to the personal features of the offspring by each ancestor severally; and the nearness of kinship in different degrees. The discussion is opened with an account of the processes in heredity, in which a distinction is marked between natural and acquired peculiarities, and family likeness and individual variation, latent characteristics, blending and mutually exclusive heritages, and petty influences are considered. The man being usually one twelfth larger than the woman, a rule is found for transmuting female into male measures so as to fix a uniform standard, applicable to either sex. The term "particulate inheritance" is defined as relating to the bits of elements which we inherit from this progenitor and that, and as covering the incalculable number of small and mostly unknown circumstances that influence our development. In a chapter on "Organic Stability" the effort is made to show, by familiar illustrations from common things, how types may come about and be perpetuated; how "sports" may suddenly appear and then endure; and, from this, that evolution is not by minute steps only, but may occur by jumps. The account of the method by which the author's "schemes" and his rules for estimating the value of his results were prepared is minute and exact, hard as a mathematical demonstration to follow, but, like a mathematical demonstration, clear

when the processes are matured. By it is deduced an equation suggesting a theory of descent, to be applied in the subsequent investigations. The investigations were made by the aid of experiments on sweet peas (the sizes of the peas of a crop), and on moths bred for the purpose, and of about a hundred and fifty family records. The records, of course, include facts relating to a vastly larger number of persons. The chief subjects to which they relate are stature, eye-color, temper, the artistic faculty, some forms of disease, marriage selection, and fertility. The item of stature offers many advantages in the study—from the ease and frequency with which it may be measured and its practical constancy during many years, from the fact that it is not a simple element, but is the sum of the accumulated lengths or thicknesses of many bodily elements, and because its discussion need not be entangled with considerations of marriage selection, and its variability is normal. To the inheritance of stature each mid-parent (median between the two parents) contributes an influence marked as one half, each individual parent one quarter, and each individual grandparent one sixteenth. A like hereditary relation is found to exist between the man and his ancestors in the matter of eye-sight. In point of the artistic faculty, highly artistic people intermarry, while moderately artistic people do not so usually, because, "A man of highly artistic temperament must look on those who are deficient in it as barbarians; he would continually crave for a sympathy and response that such persons are incapable of giving. On the other hand, every quiet unmusical man must shrink a little from the idea of wedding himself to a grand piano in constant action, with its vocal and peculiar social accompaniments; but he might anticipate great pleasure in having a wife of a moderately artistic temperament, who would give color and variety to his prosaic life. On the other hand, a sensitive and imaginative wife would be conscious of needing the aid of a husband who had enough plain common sense to restrain her too enthusiastic and frequently foolish projects." And *vice versa*. Of the problem as related to disease, the author observes: "The vital statistics of a population are those of a vast army marching rank behind rank, across the treacherous table-land of life. Some of its members drop out of sight at every step, and a new rank is ever rising to take the place vacated by the rank that preceded it, and which has already moved on. The population retains its peculiarities, although the elements of which it is composed are never stationary; neither are the same individuals present at any two successive epochs. In these respects a population may be compared to a cloud that seems to repose in calm upon a mountain plateau while a gale of wind is blowing over it. The outline of the cloud remains unchanged, although its elements are in violent movement and in a condition of perpetual destruction and renewal. . . . Both in the cloud and in the population there are continual supply and in-rush of new individuals from the unseen; they remain awhile as visible objects and then disappear. The cloud and the population are composed of elements that resemble each other in the brevity of their existence, while the general features of the cloud and of the population are alike in that they abide." One of the striking facts disclosed in the classification of the diseases of each family is their great intermixture. We know very little about the effects of such mixture, how far they are mutually exclusive, and how far they blend; or how far, when they blend, they change into a third form. Owing to the habit of free intermarriage, no person can be exempt from the inheritance of a variety of diseases, or of special tendencies to them. While death by mere old age and failure of vital powers appears common, it is not found, as a rule, that the children of persons who die of old age have any marked immunity from specific diseases. Applying the inquiry to consumption, the law of heredity found to govern the other faculties examined appears to govern that of liability to this disease also, although the constants of the formula differ slightly. It is not possible that more than one half of the varieties and number of each of the parental elements, latent or personal, can, on the average, subsist in the offspring; for a calculation based upon the supposition that they can all be conveyed would soon lead into absurdities. But if the personal and latent elements are transmitted on the average in equal numbers, it is difficult to suppose that

there can be much difference in their variety. Mr. Galton's inquiries, as a whole, can be hardly regarded as more than pioneer work, the determinate and accurate results of which have yet to be brought out. The conclusions, he remarks, "depend on ideas that must first be well comprehended, and which are now novel to the large majority of readers, and unfamiliar to all. But those who care to brace themselves to a sustained effort, need not feel much regret that the road to be traveled over is indirect, and does not admit of being mapped beforehand in a way they can clearly understand. It is full of interest of its own. It familiarizes us with the measurement of variability, and with curious laws of chance that apply to a vast diversity of social subjects. This part of the inquiry may be said to run along a road on a high level, that affords wide views in unexpected directions, and from which easy descents may be made to totally different goals from those we have now to reach."

THE CRITICAL PERIOD OF AMERICAN HISTORY. 1783–1789. By JOHN FISKE. Boston: Houghton, Mifflin & Co. Pp. 368. Price, $2.

ON hearing the news of the treaty which ended the Revolutionary War, Thomas Paine stopped the publication of "The Crisis," declaring, "The times that tried men's souls are over." So far from this being the case, Prof. Fiske says, "The most trying time of all was just beginning. It is not too much to say that the period of five years following the peace of 1783 was the most critical moment in all the history of the American people." The American commonwealth was then a tender plant, beset by many and varied dangers, and only the most judicious management could have preserved its life until it had taken firm root. Prof. Fiske in his first chapter recounts the negotiations at Paris in 1782 and 1783 in regard to the treaty of peace, giving especial attention to King George's troubles with his successive cabinets, and their bearing on the questions at issue. This is followed by a survey of the changes in forms of government, and in regard to the succession of property, slavery, and church establishment made by the thirteen commonwealths in consequence of obtaining independence of England. The next two chapters tell of the obstacles thrown in the path of Congress by the discontent of the unpaid army; by the unwillingness of the people to pay taxes for the support of the General Government, or to pay their debts to British creditors; by their jealousy of any semblance to royal power or hereditary privilege; by the commercial hostility between the States, and State quarrels over conflicting boundary claims; by the poverty of the country and the confusion of the currency —until finally insurrections in some of the States forced upon a majority of the people the conviction that something must be done, and done quickly. The author then shows how a spirit favorable to strengthening the national Government grew out of various occurrences. One of these was the settlement of the conflicting claims of the States to lands west of the Alleghanies by the surrender of all these claims to the United States; another was a difficulty with Spain in regard to the navigation of the lower Mississippi. The convention which drew up the new Constitution was led up to in a most cautious way. "At first," says Prof. Fiske, "it was to be just a little meeting of two or three States to talk about the Potomac River and some projected canals"; then commissioners from all the States were invited to be present and discuss some uniform system of legislation on the subject of trade; and, finally, the plan for a convention to devise provisions "to render the Constitution of the Federal Government adequate to the exigencies of the Union" was officially adopted by Congress.

The story of the work done by the Federal Convention forms the chief chapter of the volume, and is told in a way to show the interactions of the opposing and diverging forces whose resultant was the Constitution of the United States. Then follows an account of the discussion and ratification of the document by the several States, and the election and inauguration of Washington as President, and the critical period of American history was safely passed. Prof. Fiske offers his book to the student of American history, not as a complete summary of the events of the period which it covers, nor as a discussion of the political questions involved in them, but rather as a grouping of the main facts in such a way as to bring out their causal sequence.

THE PLAYTIME NATURALIST. By Dr. J. E. TAYLOR, F. L. S., Editor of "Science-Gossip." With 366 Illustrations. New York: D. Appleton & Co. Pp. 287. Price, $1.50.

No better statement of the scope and spirit of the "Playtime Naturalist" can be given than by quoting its preface entire. It is as follows: "The writer of this book has a liking for intelligent English lads, just as some people have for blue china and etchings. He ventures to think the former are even more interesting objects. And, as the writer was once a boy himself, and vividly remembers the never-to-be-forgotten rambles and observations of the objects in the country; and, moreover, as he treasures up such reminiscences as the most pleasant and innocent of an active man's life, he thought he could not do better than enlist this younger generation in the same loves and the same pleasures. He has endeavored to do his best for his human hobbies, and hopes their lives may be richer and sweeter and more manly for what he has introduced them to in the following pages."

The book is a story of the collecting done by the boys of "Mugby School," and its style may be seen in the section relating to fish-scales, published in the May number of this magazine. There is a delightful chapter early in the volume entitled "Among the Birds," and this is followed by a fascinating account of moth and butterfly collecting. A variety of insects of land and water, land shells, frogs, newts, etc., and microscopic animals and plants, receive attention in turn. The descriptions are accompanied by an abundance of illustrations, which aid in identifying the creatures described, and add much to the attractiveness of the volume. No book better adapted to arouse a love of nature in the young has been published in a long time.

AN ELEMENTARY TEXT-BOOK OF CHEMISTRY. By WILLIAM G. MIXTER, Professor of Chemistry in Yale University. New York: John Wiley & Sons. Pp. 459. Price, $2.50.

THE author states as the aim of this book, to enable the student to grasp the fundamental principles of the science, and at the same time to learn something of the chemistry of common things. The work is adapted to students of college age. The "periodic classification" has been made the basis of arrangement. The acidic and basic groups are treated alternately in order to discuss bases and salts early in the course, as well as to give constant variety to the character of the experiments performed. Compounds of the rare elements are described, to make evident the reasons for the classification, and also to serve as a basis for the summaries of the groups. Graphic and constitutional formulas are much used. The reasons for a number of constitutional formulas are given, and, in case of compounds whose constitution is not understood, care is generally taken to state that the constitutional formulas employed are assumed from analogy. Considerable matter intended for reading rather than recitation is distinguished by small type. The volume is introduced by a short chapter on the physics of chemistry, which includes an account of crystallography and of the laws of gases. Detailed directions for experiments, and a large number of figures of apparatus, are given. Much pains is taken to show the relationship between the members of each group by means of summaries. Presentations of chemical principles are scattered at intervals through the book.

NATURE AND MAN. ESSAYS SCIENTIFIC AND PHILOSOPHICAL. By WILLIAM B. CARPENTER, with an Introductory Memoir by J. ESTLIN CARPENTER. New York: D. Appleton & Co. Pp. 483. Price, $2.25.

THE fifteen essays contained in this volume represent chiefly the latter phases of Dr. Carpenter's thoughts on the problems concerned with the interpretation of nature and man. He believed some of the conclusions which they embody to be of high importance in the guidance of life. They were the result of long observation, and in some cases differed widely from the ideas which his early education and his first studies had led him to adopt. Mr. J. Estlin Carpenter undertakes in the "Memorial Sketch" to indicate some of the processes which contributed to this change, and to present briefly the connection between Dr. Carpenter's varied work and the personality from which his many-sided energy flowed out. An interesting and instructive delineation is given of the various phases which Dr. Carpen-

ter's views, particularly those bearing upon the relations of theological and scientific thought, underwent in the course of his transition from strict teleologism to the full acceptance of the theory of evolution. He received his early education under the superintendence of his father, a Unitarian minister, who was accustomed to insist in his teaching on the importance of bringing the reasoning powers to bear upon observed facts—a principle which the philosopher applied well in his after-studies. In his sixteenth year he became interested in Mr. Exley's "New Theory of Matter," a book devoted to showing that "all the attractions of gravitation, cohesion, electricity, chemical, magnetic, etc.," can be explained upon the same principles. It was a first attempt to demonstrate the correlation of forces. While Dr. Carpenter was active in prosecuting his physiological investigations, and had already touched upon the similarity in the character of the laws regulating vital and physical phenomena, the affairs of his religious society obtained a nearly equal share of his interest. He cultivated music, particularly organ music, with great assiduity. With this taste, and partly directing it, perhaps, was associated the preparation of a collection of psalm-tunes for his little chapel at Edinburgh. His adherence to the Unitarian faith barred him from a professorship in the university, for which he desired to be a candidate. When he had removed from Edinburgh, he felt the loss of public worship more than any other inconvenience of his situation, and wished he could be back at his old post, where he could take his part in leading the "devotional feelings of the congregation." When the "Vestiges of Creation" appeared, a few of its conceptions were found to be so similar to thoughts that he had expressed, that some readers attributed it to him; but he was not prepared to accept the main doctrine of that book, and answered it by saying that, as we had scriptural authority for believing that the Creator formed man out of the dust of the earth, he must confess his predilection for believing that the Creator had at some period "endowed certain forms of organic matter with the properties requisite to enable them to combine at the fitting season into the human organism"—rather that that we are descended from a chimpanzee. He taught that a common designed plan reigned in the evolution of the solar system, of human forms, and of the entire organic world; believed thoroughly in the reality of miracles; and held that man is accountable to the Creator for all his acts, even those that are really God's own. While this was going on, his views concerning the correlation of forces were taking more definite shape, his studies of the nervous system were becoming expanded and leading him to modified opinions concerning the will and moral responsibility. When Darwin's "Origin of Species" appeared, "he was well fitted to appreciate the general argument," for he had long thought on the subject of modification by descent, and while he had rejected the theory of the "Vestiges," "it had been on the grounds of insufficient evidence and physiological error, not from theological prepossession." He had written to his brother Russell in 1874, that one of his great desires was "to be of some use as a mediator in the conflict which has now distinctly begun between science and theology. I see quite clearly that it is of no use to try to grapple with the subject unless one thoroughly masters the question on both sides." His views on the questions raised by Darwin's theory are specifically expressed in a semi-autobiographical article on "Darwinism in England," which he published in Malta in 1881, and which is given in Mr. Estlin Carpenter's "Memorial." His theological views were disturbed by this course of thinking, but he wrote in a letter: "I believe that these difficulties are a necessary result of the habits of thought which have been growing up with me; and, as they never obscure my view of duty, I find it better not to trouble myself too much about them, but to apply myself to the business of the time." Through these difficulties, Dr. Carpenter, we are told, "after no long interval, worked his way. The strong religious needs of his nature found their satisfaction in the view of the world depicted in the later essays in this volume." Of the essays in the present collection, five relate to physiology, the brain, muscular movement, and force; three, to man as the interpreter of nature, the psychology of belief, and the "Fallacies of Testimony in Relation to the Supernatural"; two, to human automatism; one, to "The

Deep Sea and its Contents"; four, to "The Force behind Nature," "Nature and Law," "The Doctrine of Evolution in its Relations to Theism," and "The Argument from Design in the Organic World." The list of Dr. Carpenter's writings contains two hundred and ninety-three titles.

THE PLANTATION NEGRO AS A FREEMAN. By PHILIP A. BRUCE. "Questions of the Day Series." No. LVII. New York: G. P. Putnam's Sons. Pp. 262. Price, $1.25.

THE estimate of negro character which prevails in the Northern States, where negroes are few, has been more influenced by knowledge of the wrongs which the race has suffered than by acquaintance with the actual habits of the black people. Mr. Bruce's volume will dispel any too ideal view of the black race which the reader may hold. It is a very thorough presentation of their mental and moral traits, as exhibited in all the important relations of life, based upon observations of the author extending over a long series of years since emancipation, in "Southside Virginia," a region containing a colored population of about two hundred and fifty thousand. Mr. Bruce represents the negro as a careless and capricious parent, as being decidedly lax in regard to the marriage tie, as depending on firm management for his value as a servant, and as humble or impertinent in demeanor toward the whites according to the way he is treated. His crimes are of the impulsive class—he is not a cool and calculating villain. As a voter he is easily led astray, and is becoming readily purchasable. His religion is emotional, and has but little influence on his conduct. He is highly superstitious, and has great faith in the trick doctor. The author thinks that the ordinary sort of education furnished the negro hurts him in some ways, as well as helping him, and that a system modified so as to be adapted to his character would be much more of a benefit. About the same that was said of the black as a servant applies to him as a farm laborer. He delights to own or rent land, but his laziness makes him an undesirable tenant. As a mechanic he is generally only a helper. Mr. Bruce regards the negro not as being essentially depraved, but as having many unfortunate weaknesses, and this opinion dominates the view as to the future of the race which he gives in the closing chapter. He regards the proper solution of the negro problem as a matter of profound solicitude to a large and important part of our country.

A MANUAL OF INSTRUCTION IN THE PRINCIPLES OF PROMPT AID TO THE INJURED. By ALVAH H. DOTY, M. D. New York: D. Appleton & Co. Pp. 224. Price, $1.25.

IN order that the subject of this volume may be well understood, it is essential to know something of the construction of the human body and the functions of the different organs. For this reason the author devotes about a third of the volume to anatomy and physiology. Coming to the application of this knowledge, he describes the use of roller bandages, of four-tailed, square, triangle, and cravat bandages; of slings, compresses, and tampons; also the tying of knots, the making of poultices, and the application of moist and dry heat. Half a dozen pages are devoted to antiseptics and deodorants. The various forms of injury are then described, and the proper treatment for each is stated. Under wounds, the bites of dogs and snakes are included. The chapter on hæmorrhage contains a diagram showing the position of the important arteries, and a cut of a suspender so devised as to be especially useful in case of emergency for constricting a bleeding limb. The use of various articles likely to be at hand as temporary splints and slings in cases of fracture is described. A variety of injuries, many of them involving unconsciousness, receive due attention. Among these are burns, frost-bite, fainting, stunning, intoxication, fits, hysteria, and heat-stroke.

In the treatment of drowned persons, three methods of artificial respiration are given, with figures. There is a chapter on poisons, and another in which a variety of injuries and affections are treated, including convulsions of children, bed-sores, chafing, etc. The last chapter is on transportation of the patient, either with or without a litter, manufactured or extemporized, and includes by permission that part of the "Manual of Instruction for Hospital Corps, U. S. A." which relates to transportation of the wounded, with the cuts. The author states that special effort has been made to so arrange the matter and to introduce such points as

will make the book of use to the ambulance corps connected with the different military organizations. He has endeavored to explain each topic in a simple manner, and when medical terms are used their lay synonyms are also given. Numerous illustrations have been inserted to aid in making the work readily intelligible.

THE INSANE IN FOREIGN COUNTRIES. By WILLIAM P. LETCHWORTH. New York: G. P. Putnam's Sons. Pp. 374. Price, $3.

THIS volume, by the President of the New York State Board of Charities, is an important contribution to the literature of its subject. It embodies an examination of European methods of caring for the insane, especially the insane in public institutions, pursued without interruption for seven months, supplemented by information obtained since the time of the author's visit. By way of contrast, a brief introductory sketch of the ways in which the insane were treated in earlier times is given. The systems employed in England, Scotland, and Ireland are then described in turn, and the characteristics of representative Continental institutions are set forth. A chapter each is given to the insane colony of Gheel, in Belgium, where is the celebrated shrine of St. Dymphna, and to the colony-hospital at Alt-Scherbitz in Saxony. The final and longest chapter, and the most important portion of the volume, presents a *résumé* of the author's observations and his conclusions drawn from them. Based upon the results of his inspections of foreign and American asylums, and of his own experience in the supervision of the defective classes of New York State, Mr. Letchworth offers his views as regards the selection of sites and locations of asylums, the kind of buildings to be provided; the questions of sewage disposal, water-supply, protection against fire, the laying out of the grounds, the furnishing and decoration of wards and rooms, the difficult problem of the disposition of the acute, the chronic, and the criminal insane; the practice of restraint and the amount of liberty that may be granted; the character of the attendants to be chosen; the religious exercises, amusements, employments, dress and clothing, visitation and correspondence of patients, *post-mortem* examinations; the methods of admission and discharge, and the value of summer resorts. All these subjects are treated clearly and explicitly. Besides these, the author gives his personal views respecting the insane in poor-houses, local or district care of the insane, state care, the boarding-out system, state supervision, and kindred topics. The book is beautifully printed and richly illustrated with engravings and heliotype reproductions of plans of buildings and asylum interiors, and pictures of historical interest.

GEOLOGICAL SURVEY OF NEW JERSEY. FINAL REPORT OF THE STATE GEOLOGIST. Vol. I. Topography, Magnetism, Climate. By GEORGE H. COOK, State Geologist. Trenton: John L. Murphy Publishing Company. Pp. 439, with Maps, etc.

THE survey was authorized by the State Legislature in 1864, and has been continued regularly till the date of the report. The act contemplated a completion of the work, previous partial surveys having been carried on by Henry D. Rogers in 1836–'40, and Dr. William Kitchell in 1854–'56. While the yearly reports of the present work that have been made and liberally distributed among the people have been somewhat miscellaneous as to the subjects discussed, on account of the prominence of special wants and interests, the various branches of the survey have been kept advancing, so that it has been found practicable to include the final geographical reports in this volume. The State Geologist has enjoyed the co-operation and assistance of the United States Coast and Geodetic Survey; and the expense of conducting the latter half of the topographical work has been borne by the United States Geological Survey. Of the several parts of the present volume, the article on the Geodetic Survey, by Prof. Bowser, of the Coast Survey, gives accurate determinations, in latitude and longitude, of several hundred points, the stations of which are exactly described, and the primary ones distinctly marked on the spot. In the "Physical Description," Mr. C. C. Vermeule, after defining the geographical position and outlines of the State, relates the history of the questions of boundary and limits of jurisdiction from the beginning; marks the political divisions, with measurements of the areas of the counties and townships, and describes the topography of the State as being "readily classed

in belts which correspond closely with the outcrops of the various geological formations. Beginning at the northwest, we have the Kittatinny Mountain and Valley, occupying the western half of Sussex and Warren counties, and corresponding to the Palæozoic formation; next, the Archæan Highlands; then the rolling Triassic or red sandstone plain; then the furrowed and irregularly hilly cretaceous plain; and, lastly, the triangular, extremely level, sandy, and pine-clad plain of the Tertiary formation, fringed seaward by a belt of tide-marsh inclosed from the sea by sand-beaches. These features are common to the Atlantic slope southwest." In the detailed review these belts divide themselves up into alternating streaks of mountain and valley, table and plain, of which twenty-four are described. These divisions present, considering the limitations of the area, much diversity of aspect, from the mountain lands of the northwest, studded with lakes, with the trap dikes of the "red sandstone plain" intervening, to the swamps and pine plains and tidal plain and beach sands as we approach or when we reach the sea-coast. The description is supplemented by a table giving the areas of the several water-sheds, with the percentage of forest upon them, and their population per square mile, a list of bench-marks at which the elevation above the sea is exactly recorded; and a much larger list of elevations, from the latest and best determinations of prominent points, referred to mean sea-level. The paper on the Magnetic Survey, recording observations at one hundred and fifty-eight stations, reveals some noteworthy irregularities in declination, particularly in regions of Archæan rock, and near the trap ridges, where a tendency of the needle toward a perpendicular to the crest-line of the ridge is remarked upon. This paper is accompanied by a chart showing equal lines of declination for 1888. Prof. Smock describes four natural climatic provinces in the State, each of which has its peculiar features: the Highlands and Kittatinny Valley; the Red Sandstone Plain; the Southern Interior; and the Sea-shore, or Atlantic Coast Belt. The first is not generally marked by excessive extremes of temperature, but has rather a northern climate. The last, though having nowhere a truly mild winter climate—like that of southern Florida and California, etc.—affords pleasant winter resorts. In view of the small area of the State, the variety of conditions to be found in New Jersey appears a little remarkable. A fine topographic map, and an altitude map, in which nine grades of elevation are indicated by as many distinct shades of coloring, are furnished in pockets.

ACTIVITY is resumed by the Society for Political Education by the issue of a pamphlet, No. 25 in its series, on Electoral Reform." It sets forth the grave defects in the electoral systems of most of the States, and explains the remedies therefor in secrecy of ballot and other reforms. The "New York (Saxton) Bill" and the "Massachusetts Ballot Reform Act" are appended. The next forthcoming publication of the society will deal with the "Liquor Question in Politics," and as soon as possible it will revise and reissue its list of standard works on economics, political history and science, and economic reforms, for the direction and aid of students and the general reading public. The society aims at awakening an intelligent interest in governmental methods and purposes, and at diffusing information concerning the rights and duties of citizens. Mr. George Iles, secretary, 330 Pearl Street, New York, invites the co-operation of all interested in the society's work.

The Self: What is it? is the problem which Mr. *J. S. Malone* attempts to answer (J. P. Morton & Co., Louisville, 75 cents). He divides the human mind into two parts —intellect and sensibility—and affirms that the faculty which causes all human activity is desire, a subdivision of sensibility, challenging any one to find one voluntary human action that can be traced back to intellect as its primal cause. He deems intellect only instrumental. He affirms that moral responsibility belongs also to sense, and that the end of existence concerns only this department of mind. In the second division of his book he maintains that intellect is an offshoot from sense, and examines some of Kant's doctrines.

Mr. *Frederic E. Ives* has privately printed in Philadelphia a brief account of his process of photographing in colors, under the title *A New Principle in Heliochromy*. He

alludes to the various attempts which have been made to produce photographs in natural colors, and then states the essential features of his own method. He says in conclusion that there is much yet to be done in perfecting the print-making part of the process, and that for the present he is satisfied to obtain perfect heliochromic prints on glass, so that the result may be shown with the optical lantern. He appends a reply, which he made in the "Journal of the Franklin Institute," to a criticism on his claims by Mr. C. H. Bothamley. The *brochure* has a photo-engraved portrait of Mr. Ives as frontispiece.

A lecture entitled *Outlines of a New Science*, by *E. J. Donnell*, has been published in the "Questions of the Day Series" (Putnam, $1). The author maintains that *exchangeability* is the source of economic value, that all wealth is the fruit of commercial exchange, and that, when this is going on actively, all departments of productive industry have health and vigor. Further, that the recent enormous increase in the productive powers of labor has created a problem which demands an immediate solution; that the problem is especially pressing in this country because our productive powers are greater and the restrictions on our commercial exchanges more oppressive than in any other of the advanced industrial nations; and that our tariff system taxes the many for the benefit of the few.

The Trustees of the Peabody Museum of American Archæology and Ethnology have begun to issue from time to time such special papers as have heretofore been published in connection with the annual reports, in a separate form, but of uniform octavo size with the reports. Each number will be sold separately at a specified price, which will vary according to the number of pages and illustrations. The papers will be omitted from the annual reports. The first of these papers published is an interesting essay by Mrs. Zelia Nuttall, on a "Relic of Ancient Mexico—Standard or Head-dress?"—with three colored plates, to which is appended a note "On the Complementary Signs of the Mexican Graphic System."

The *Plans for furnishing an Abundant Supply of Water to the City of New York from a Source independent of the Croton Water-shed*, proposed by *John R. Bartlett and Associates*, contemplate the utilization of the Passaic water-shed in New Jersey; the reservoirs to be located about fifteen miles from the city, and the water to be brought in by a tunnel under the Hudson River. The supply of all the New Jersey towns suburban to New York, and of Brooklyn, is declared to be practicable by the same system, and it is claimed that the quantity of water available for this purpose is sufficient to furnish them all abundantly. The water-privileges of the region in question are owned by private corporations, from which the author has obtained concessions of the right to construct reservoirs and collect and use the surplus waters. In behalf of this scheme, it is claimed that the Passaic water-shed has three times the area of the Croton water-shed, and is therefore capable of affording a much larger supply of water than can ever be derived thence; that it is much nearer to the city; that the water can be brought direct to the lower part of the city, where it is most needed; that it will be pure and wholesome, and, being delivered under a head-pressure of three hundred feet, will go of its own force to the tops of the highest houses, and with sufficient energy to be instantly available in extinguishing fires; and that it possesses other somewhat less important but obviously convenient advantages. The book in which the scheme is developed and explained contains several addresses and memoirs, legal opinions, and opinions of experts on the various questions brought out in the discussions of it, with maps, plans, profiles, and views.

Mr. *Charles W. Darling*, Corresponding Secretary of the Oneida Historical Society, has published privately, in a pamphlet of 43 pages, some *Historical Notes concerning the City of New York* as it appeared in its earliest days. They have been gathered from the writings of the chief historians, earlier and later, of the city, and from manuscript folio volumes of public records. They contain matter that is omitted by one or other, or more, of the writers quoted from, and form a picture as a whole which it will be hard to find in its fullness anywhere else. The notes date back to the period when trading and fishing huts were first erected upon Manhattan Island, and embrace the years between

the discovery by Hudson in 1609 and the recall of Governor Wouter Van Twiller in 1637.

Business is one of half a dozen thoughtful little books by *James Platt*, on kindred subjects and with equally terse titles (Putnam, 75 cents). It is a clear, vigorous, and direct statement of the nature and importance of each of the qualities which make up the mental fittings of the successful man of business. The author has long advocated the teaching of business methods in English schools, so that the youth of that country might be competent to fill the clerkships which English merchants are constantly giving to Germans and Swiss. He regards commercial life as a remorseless struggle for existence, in which the men of greatest skill and perseverance defeat their fellows. He repudiates the doctrine of the weak, indolent, and thoughtless that puts all failure upon the Lord, and says that if men do not succeed it is because they are not equal to the requirements of the age they live in. Mr. Platt does not hold that reading books alone will make any one a thorough man of business, but that books can supply knowledge of laws and principles which, if intelligently applied, will prevent failure or be productive of success.

D. C. Heath & Co. are about to publish *Thirty-six Observation Lessons on Common Minerals*, by *Henry L. Clapp*, designed as a practical guide for the use of the teacher in directing the pupil's energies, and cultivating the true scientific habit of thinking and working. The same firm will issue *The Laws of Health in Relation to School Life*, by *Arthur Newsholme*, M. D., intended for the guidance of all who are charged with the responsibility of watching over the mental and physical well-being of pupils of both sexes in public or private schools. The book is in use in English training schools, and the American edition has been carefully revised to adapt it to our climate and the needs of our schools.

PUBLICATIONS RECEIVED.

Adams, Robert C. Pioneer Pith. The Gist of Lectures on Rationalism. New York: The Truth-Seeker Company. Pp. 99. 25 cents.

Angerstein, E., M. D., and Eckler, G. Home Gymnastics for the Well and the Sick. Boston and New York: Houghton, Mifflin & Co. Pp. 94. $1.25.

Bennett, Alfred W., and Murray, George. A Hand-book of Cryptogamic Botany. London and New York: Longmans, Green & Co. Pp. 478. $5.

Bastin, Prof. Edson S. College Botany. Chicago: G. P. Engelhard & Co. Pp. 451. $3.

Benson, Lawrence Sluter. Mathematics in a Nutshell, etc. 25 Bond Street, New York. Pp. 10.

Bert, Paul. Primer of Scientific Knowledge. Translated and adapted for American Schools. Philadelphia: J. B. Lippincott Company. Pp. 186. 86 cents.

Boylston, Peter. John Charáxes: A Tale of the Civil War in America. Philadelphia: J. B. Lippincott Company. Pp. 289. $1.25.

Branner, John C. Annual Report of the Geological Survey of Arkansas. Little Rock. Pp. 320, with Maps.

Bryce, James. The American Commonwealth. London and New York: Macmillan & Co. 2 vols. Pp. 750 and 743. $6.

Burt, Stephen Smith, M. D. Views on the Prevention and Treatment of Typhoid Fever. New York. Pp. 11.

Connecticut Agricultural Experiment Station. Bulletin No. 97. Fungous Diseases of Plants. Pp. 13.

Crothers, T. D., Editor. "The Quarterly Journal of Inebriety." April, 1889. Hartford, Conn.: The Case, Lockwood & Brainard Company. Pp. 100.

Danmar, William. The Tail of the Earth; or, the Location and Condition of the "Spirit World." Brooklyn, N. Y. Pp. 60. 25 cents.

Dexter, Seymour. A Treatise on Co-operative Savings and Loan Associations. New York: D. Appleton & Co. Pp. 299. $1.25.

Dunham, O. M. "The American Workman." An Illustrated Magazine. New York. Pp. 16. 5 cents; $2.50 a year.

Foote, E. B., Jr., M. D. Dr. Cyrus Edson's Plea for Compulsory Vaccination reviewed. Pp. 16.

Foster, Michael, and others. "The Journal of Physiology." Vol. X. Nos. 1 and 2. Pp. 151 and iv, with Plates. $5 a volume.

Groh, Israel W. Did Man fall? New York: The Truth-Seeker Company. Pp. 21. 10 cents.

Hill, Robert T. Events in North American Cretaceous History illustrated in the Arkansas-Texas Division. Austin, Texas. Pp. 10.

Hitchcock, C. C. The Influence of Science on Religious Thought. Ware, Mass. Pp. 17.

Illinois, University of. Agricultural Experiment Station. Field Experiments with Corn. 1888. Pp. 102.

Ingersoll, Robert; Condert, Frederick A.; and Woodford, Stewart L. The Limits of Toleration. A Discussion. New York: The Truth-Seeker Company. Pp. 44. 10 cents.

Iowa Agricultural College Experiment Station. Ames. Bulletin No. 4. Pp. 48.

Jacobi, Mary Putnam, M. D. Physiological Notes on Primary Education and the Study of Language. New York and London: G. P. Putnam's Sons. Pp. 120. $1.

Johns Hopkins University Circulars. No. 72. Pp. 12.

Leffmann, Henry, and Beam, William. Examination of Water for Sanitary and Technical Purposes. Philadelphia: P. Blakiston, Son & Co. Pp. 106. $1.25.

Linnæan Society of New York City. Abstract of Proceedings for 1888–'89. Pp. 9.

McGee, W J. Notes on the Geology of Macon County, Missouri. Pp. 82.—Classification of Geographic Forms by Genesis. Pp. 10.—Dynamical Geology. Pp. 6.

McKenzie, F. J., editor. Discussion of the Medical Bill, Regulars vs. Quacks. Oshkosh, Wis. Pp. 32.

"Minnesota, Public Health in." February, 1889. Monthly, with supplement. Pp. 82 and Chart. 50 cents a year.

Massachusetts State Agricultural Experiment Station. Sixth Annual Report of the Board of Control. Amherst. Pp. 264.—Bulletin No. 28. On Commercial Fertilizers. Pp. 12.

Michigan, Agricultural College of. Report of the Weather Service Department and Rainfall Charts. Pp. 33.—Feeding Steers of Different Breeds. Pp. 29, with Plates.—Why not plant a Grove? Pp. 7.—Potatoes, Roots, Fertilizers, and Oats. Pp. 12.

Montgomery, D. H. The Leading Facts of French History. Boston: Ginn & Co. Pp. 321. $1.25.

New York. Report of the Commissioners of the State Reservation at Niagara for 1888. Pp. 112, with Plates.—Report of the Central Park Menagerie. Pp. 43.—University of the City of. Catalogue and Announcements. 1888-'89. Pp. 144.

Old South Leaflets. Washington's Inaugurals. Boston: D. C. Heath & Co. Pp. 12. 5 cents.

Parker, Francis W. How to study Geography. New York: D. Appleton & Co. Pp. 400. $1.50.

Perrin, B. Homer's Odyssey. Books I to IV, with Notes. Boston: Ginn & Co. Pp. 229. $1.40.

Pickering, Edward C. Henry Draper Memorial. Third Annual Report of the Photographic Study of Stellar Spectra. Pp. 8.—A Photographic Determination of the Brightness of the Stars. Pp. 214.

Potts, William. Evolution of Vegetable Life. Boston: The New Ideal Publishing Company. Pp. 28. 10 cents.

Powell, J. W., Director. Seventh Annual Report of the United States Geological Survey, 1885-'86. Washington: Government Printing-Office. Pp. 656, with Map and Plates.

Proctor, Richard Anthony. The Student's Atlas. London and New York: Longmans, Green & Co. Twelve Circular Maps. $1.50.

Rauch, John H., M. D. Water Supplies of Illinois and the Pollution of its Streams. Springfield, Ill. Pp. 81.

Rane, C. G., M. D. Psychology as a Natural Science applied to the Solution of Occult Psychic Phenomena. Philadelphia: Porter & Coates. Pp. 541. $3.50.

Raymond, Rossiter W. Evolution of Animal Life. Boston: The New Ideal Publishing Company. Pp. 22. 10 cents.

Rotch, A. Lawrence. Observations made at the Blue Hill Meteorological Observatory, Massachusetts, in 1887. Cambridge, Mass.: John Wilson & Son. Pp. 141, with Plates.

Shufeldt, R. W. Osteology of Circus Hudsonius. Pp. 33.

Sonrel, A., and Jordan, David Starr. Six Species of North American Fresh-Water Fishes. Drawings and Explanation of Plates. Washington: Smithsonian Institution.

Townshend, Smith, M. D. Report of the Health Officer of the District of Columbia. 1888. Washington: Government Printing-Office. Pp. 173, with Charts.

Tuttle, Hudson. Studies in the Outlying Fields of Psychic Science. New York: M. L. Holbrook & Co. Pp. 232. $1.25.

Verschoyle, Rev. J., Editor. The History of Ancient Civilization. New York: D. Appleton & Co. Pp. 295. $1.75.

Ward, Lester F. Some Social and Economic Paradoxes. Washington. Pp. 12.—An Undescribed Vegetable Organism from the Fort Union Group of Montana. Pp. 4.—The Paleontologic History of the Genus Platanus. Pp. 4, with Five Plates.

Whitman, Dr. C. O., Director. First Annual Report of the Marine Biological Laboratory, Wood's Holl, Massachusetts, for 1888. Pp. 44.

Willard, Frances E. Glimpses of Fifty Years. The Autobiography of an American Woman. Chicago: Woman's Temperance Publishing Association. Specimen pages.

Wiman, Erastus. The Greater Half of the Continent. New York. Pp. 30.

POPULAR MISCELLANY.

John Goldie.—This industrious botanist was born near Maybole in Ayrshire, March 21, 1793; died at Ayr, Ontario, Canada, where he had long resided, in June, 1886, in his ninety-fourth year. Mr. Goldie was educated as a gardener; and most Scotch gardeners in those days were botanists. From the Glasgow Botanic Garden, then in charge of Sir William Hooker, he came to America for botanical exploration in the year 1817. The interesting particulars of this expedition are here given in an abstract from his "Description of some New and Rare Plants discovered in Canada in the Year 1819," published in the "Edinburgh Philosophical Journal," vol. vi, April, 1822. "Having had for many years a great desire to visit North America, chiefly with a view to examine and collect some of its vegetable productions, I contrived in 1817 to obtain as much money as would just pay my passage there, leaving when this was done but a very small surplus." He sailed from Leith to Halifax, went to Quebec, whence he dispatched his collections of living roots and dried plants in a vessel bound for Greenock, "but never heard of them afterward." At Montreal he found Pursh, who advised him to explore the northwest country, and promised to obtain for him permission to accompany the traders going to that region the following spring. "I traveled on foot to Albany, thence proceeded by water to New York. . . . I explored the eastern part of New Jersey, a country which, though barren and little inhabited, yet presents many rarities to the botanist, and gave me more gratification than any part of America that I have seen. At a place called Quaker's Bridge I gathered some most interesting plants, and, having accumulated as large a load as my back would carry, I took my journey to Philadelphia"—thence to New York, whence a ship was about to sail to Scotland, "and, having again committed my treasures to the deep, I had again, as the first time, the disappointment of never obtaining any intelligence whatever of them. My finances being now extremely low and winter having commenced, I hardly knew what to do; but, after some delay, went up to the Mohawk River, where I found employment that season as schoolmaster"—thence in the spring

to Montreal, and, failing to make the connections necessary to reaching the northwest district, he "took to the spade" all summer long, except two days in the week which he devoted to botanizing. "In the autumn I shipped my collection of plants, and in two months had the mortification to learn that the vessel was totally wrecked in the St. Lawrence. During the next winter I did little, except employing myself with such skill as I was able in designing some flower-pieces, for which I got a trifle. Early the following spring I commenced labor again, and by the beginning of June had amassed about fifty dollars, which, with as much more borrowed from a friend, formed my stock of money for the next summer's tour. I started in the beginning of June from Montreal, and passing through Kingston went to New York [meaning the State, evidently], to which, after an excursion to Lake Simcoe, I returned; then visited the Falls of Niagara and Fort Erie, and crossed over to the United States, keeping along the eastern side of Lake Erie"; he crossed over to Pittsburg, back by way of Olean, Onondaga, and Sackett's Harbor to Montreal, and thence safely home to Scotland, "the plants I carried with myself being the whole that I saved out of the produce of nearly three years spent in botanical researches." Hard lines these and in those days for collecting botanists, which those who "stay at home at ease" do not appreciate. In the year 1824 he was commissioned to take charge of a cargo of living plants sent by the Edinburgh Botanic Garden to that of St. Petersburg. On his return he went into the nursery business in his native country. Then, with a laudable wish to better the prospects of his family, in 1844 he transported his home from the Scotch to the Canadian Ayr, in the province of Ontario, where he flourished and prospered for over thirty years of green old age, and died in the midst of numerous and prosperous children, grandchildren, and great-grandchildren.

Tornadoes.—Mr. J. P. Finley says that there are two principal conditions upon which the occurrence of tornadoes depends: one is a state of unstable equilibrium in the air, and the other a circulatory motion with reference to any center of disturbance. Tornadoes are most likely to occur in regions where warm moist air flows underneath a colder and drier stratum coming from another direction. Such regions are found in the Mississippi, Missouri, and Ohio Valleys, and in Alabama, Georgia, and the Carolinas. The summer season is the most favorable for tornadoes, when the interior of the continent is warmed up, and the air of the lower strata is drawn from lower latitudes far up into the northern portions of the country on the eastern side of the Rocky Mountains. If this unstable condition does not of itself induce a disturbance, one is readily brought about by the addition of any small effect from some other cause, as from extremely warm weather, in which the air strata close to the earth's surface become still hotter than those above them. Tornadoes very generally accompany an area of low barometer, and are to be looked for in the southeast quadrant only of the "low," at distances generally of from two hundred to five hundred miles from the center. But as the unstable state in a "low" very rarely extends down to the earth's surface, tornadoes are not necessarily visible in every general storm. The destructive violence of a tornado is sometimes confined to a path a few yards in width, or it may widen to the extreme limit of eighty rods. The tornado, with hardly an exception, occurs just after the hottest part of the day—most frequently between 3.30 and 5 P.M. The month of greatest frequency is May, April coming next. It is estimated that one hundred and forty-six tornadoes occur in the United States yearly. The vortex wind-velocities of the tornado-cloud vary from one hundred to five hundred miles an hour, from actual measurements. Velocities of from eight hundred to one thousand miles an hour are extremes that have been reported, but may not be altogether reliable. The cloud generated by the vortex assumes the form of a funnel, with the smaller end toward the earth. The characteristic effects of a tornado are objects drawn into the vortex from all sides, whirled upward and thrown outward by the circling air: structures are literally torn to pieces, as shown by the fineness of the *débris;* light objects are carried to great heights and also to great distances; persons are stripped of clothing; fowls and birds are denuded of feathers and killed; trees are whipped to bare poles, uprooted or

twisted off near the roots; heavy timbers are driven through the sides of buildings or deep into the solid earth; men and animals are terribly mangled by contact with flying *débris*, and by being swept over the surface of the ground; bowlders weighing tons are rolled along; railroad trains are thrown from the tracks; and iron bridges are carried from their foundations.

Economical Uses of Flowers.—The dried flowers of *Hemerocallis graminea* and the young flowers of the plantain pickled in vinegar are choice Chinese foods. Capers are the flower-buds of a *Capparis* or a *Zygophyllum;* and cloves are the unexpanded flower-buds of *Caryophyllus aromaticus*. The petals of safflower, *Carthamus tinctorius*, yield a beautiful dye of various shades of color between red and yellow. It is the carthamine of the pink saucers, and this, mixed with powdered mica or talc, forms a rouge for ladies' toilet-tables. The dried flowers of two species of *Butea*, locally known as *dhak*, *tisso*, *toolsee*, and *kassaree*, are extensively used in India for the production of orange and red dyes. The orange-red flowers, which grow in clusters, are pressed when fresh, or boiled or steeped when dried, in a weak solution of lime in water. The flower-buds of *Calasaccion*, which resemble a clove, the blossoms of a larkspur of Khorassan, and the white flowers of *Cedrela Toona*, give yellow dyes. The *Sophora Japonica*, a well-known ornamental shrub of our gardens, is cultivated in China for the sake of the imperial yellow dye obtained from its bunches of flowers and undeveloped flower-buds. Flowers of marigold are made into garlands in India for the idols and for the decoration of houses in festivals. The red flowers of *Hibiscus rosa-sinensis* supply a red dye, and have been used to polish boots and shoes. A fleeting orange or buff dye is extracted in India from the corolla tubes of *Nyctanthes*, which are also strung in necklaces for women. The flowers of the teak and of the pomegranate are used in India for dyeing red. The dried stigmas of the crocus are a source of saffron. Cake saffron is made of the florets pressed together with mucilage. Insect-powder is the pulverized dried flowers of *Pyrethrum*. In medicine, the female flowers of hops are tonic and narcotic; the Provence rose is considered astringent; the flowers of the hollyhock are mucilaginous and demulcent; those of *Grislea tomentosa* astringent and tonic; those of camomile tonic and anodyne. Infusion of linden-flowers is given as an antispasmodic. The flowers of the Abyssinian *Brayera anthelmintica* and the flower-heads of *Artemisia* act as vermifuges. Violets are considered purgative; but a conserve of the flowers with sugar has a grateful flavor for covering nauseous medicine. The flowers of the Indian *Mohwa* (*Bassia latifolia*) secrete much sugar, and are gathered by the natives during their season, in March and April. A single tree will yield many hundred-weights of corollas. They are eaten by the poorer classes in various parts of India. The ripe flowers have a sickly smell and a sweet taste, resembling manna, and are stored as a staple of food; when dried they have somewhat the odor and appearance of Sultana raisins; containing 63¼ per cent of sugar, they are as nourishing as grain, but people could not live on them alone for any length of time. They are distilled by the Parsees, and yield a powerful, coarse spirit. Cowslip-flowers are used in wine-making, and the flowers of meadow-sweet to improve the flavor of certain wines. Some of the Chinese teas are often scented with flowers. The kinds of flowers and the processes are various, but the object of all is to make the tea more attractive.

Forestry in Spain.—Action was taken for the promotion of forestral science in Spain toward the close of the fifteenth century; and there is reason to believe that measures had been adopted to check the destruction of timber even previous to the reign of Ferdinand and Isabella. The school of forestry, projected in 1835, went into operation ten years later, and was attached to the Escurial in 1868. It is under the direction of a head administrator and chief engineer, with nine professors and three assistants. The number of students, now ninety-two, is not limited, and is dependent on the number of successful candidates for entrance each year. On the completion of the course at the school, which lasts four years, the successful candidates are appointed to the corps of forest engineers. The course of instruction is divided into preparatory and profes-

sional categories. Candidates for admission must be qualified in Spanish and Latin grammar, geography, Spanish history, the elements of natural history, theoretical mechanics, geometry and its relations to projections and perspective, physics, chemistry, lineal, topographical, and landscape drawing, and French and German. Especial attention is given in the course to topography, chemistry, and mathematics. Branches bearing particularly on forestry are introduced in the second year, and are made more prominent in the succeeding years. The custody of the public forests is vested in the civic guard. The country is divided into forty-six forestral departments, the forests in each of which are under the care of a chief engineer.

Evening Continuation Schools. — In a paper read before the Society of Arts, London, Dr. William Lant Carpenter considered the best means of continuing the education of children who are taken from the day school as early as the law allows and set at work. He said that education to be given in the evening must be such as will attract, interest, and *recreate* tired children. It has to compete with the social gambolings of the street, or even with the gaudy, specious amusements which too often allure them. In the second place, it must touch and draw forth the opening nature of children of that age, so that their instinctive impulses and growing powers, both of body and mind, shall be rightly nourished and trained. Lastly, it must bear directly upon the practical work of their daily life, upon the pure enjoyments that are possible to them, and upon the noble duties that will devolve on them. In Nottingham a very successful attempt had been made to ingraft upon the instruction required by the Government, exercises of a more practical and recreative character, conducted by voluntary teachers, such as calisthenics, musical drills, drawing, modeling, demonstration in elementary science, geography with special reference to physical phenomena and to commerce, shopping and workshop arithmetic, needlework, historical and other readings illustrated by the lantern. Moreover, seven working men were appointed to be the managers of each school, and these men so labored that during the first year of their service the attendance was doubled. The "Recreative Evening Schools Association" was formed in London in 1886 with a similar purpose, and had accomplished valuable work, both within and outside of the metropolis. Dr. Carpenter said in regard to the use of the lantern that its value as an educational agent is only beginning to be recognized. Eyes wearied with long use during the day can not endure the fatigue of much book-work at night, but they are revived and charmed by the splendor of gay color and brilliance of light. He urged the teaching of science, not only as a preparation for technical education, but still more to put the young people into an intelligent relation with the phenomena of the world in which they live. In order to deal with the distress arising from unthrift, vice, self-indulgence, and reckless and improvident marriage in a great city like London, Dr. Carpenter said: "We must capture the boys and the girls who will be the fathers and mothers of five or ten years hence. If when captured their lives and habits are molded at the impressionable age, from fourteen to twenty-one, so as to become good citizens, and not reckless pleasure-hunters, unaccustomed to resist the impulse of passion or the suggestions of desire, we are, in point of fact, sterilizing the unfitness latent in them, and thus preventing the formation of a new national debt of vice and crime."

NOTES.

Dr. F. P. Wightnick sounds another note of alarm against danger from lead-poisoning from using fruit canned in tin. Three cases have lately come under his observation in which he assigns the cause of trouble to this source. One case is that of a patient who had been using canned tomatoes for three years, and who had for several months suffered painful disorders of digestion. Analysis of the tomatoes revealed the presence of 0·987 grain of oxide of tin and 0·339 grain of chloride of lead per pound of preserved vegetables. The other cases are of a mother and son who have eaten canned tomatoes freely, and are suffering from similar digestive disorders. The evidence of lead-poisoning is not presented in so positive a form as in the other case. Medical men and chemists have usually inclined to the opinion that the danger of poisoning from canned fruits was insignificant.

The "Quarterly Journal of Inebriety" has called attention to the indiscriminate

administration of policemen's discipline to so-called drunken cases in hot weather. Most frequently such cases are suffering far more from other causes than from liquor —from debility, heat-stroke, or some other cause peculiar to or resulting from the weather—added to a degree of intoxication which under ordinary circumstances might not attract an officer's attention—not unfrequently from the policeman's club or rough handling. The thing they need is medical attention, or at least medical examination, before being thrust into a hot, close cell.

THE meeting of the British Association for this year is to be held at Newcastle-on-Tyne, under the presidency of Prof. W. H. Flower, F. R. S. The presidents of the various sections are as follows: A, Mathematical and Physical Science, Captain W. De W. Abney, R. E., C. B., F. R. S.—B, Chemical Science, Sir I. Lowthian Bell, F. R. S.—C. Geology, Prof. James Geikie, LL. D., F. R. S. —D, Biology, Prof. J. S. Burdon-Sanderson, M. A., M. D., LL. D., F. R. S.—E, Geography, Colonel Sir Francis de Winton, K. C. M. G., F. R. G. S.—F, Economic Science and Statistics, Prof. F. Y. Edgeworth, M. A., F. S. S.—G, Mechanical Science, William Anderson, M. Inst. C. E.—H, Anthropology, Prof. Sir W. Turner, LL. D., F. R. S.

A BOTANICAL CONGRESS has been called by the Botanical Society of France, to be held in Paris in August, for the presentation and discussion of treatises on botanical subjects, pure or applied. Particular attention will be given to considering the usefulness of establishing joint action looking to the preparation of maps showing the distribution of species and genera over the globe; and to the characters for classification furnished by anatomy.

THE French Association for the Advancement of Science will meet in Paris, August 8th to 15th.

AN affection similar to sunstroke is described by the "British Medical Journal" as produced by the electric light, and is called "electric-light stroke." It is very liable to attack the men working at the electric furnace of the Creuzot steel-works. As the heat emitted by this furnace is not felt to any great degree, the fact lends probability to the supposition that the "stroke" is an effect of light rather than of heat.

THE French Academy of Sciences offers for 1889 the *Prix Vaillant*, of three thousand francs, for the best work on diseases of cereals in general; a grand prize of three thousand francs for the complete study of the embryology and development of any animal; the *Prix Bréant*, of one hundred thousand francs, for a specific against cholera; and a prize of five hundred francs for a theoretical and practical essay on the progress of aërial navigation since 1880.

OBITUARY NOTES.

M. CHEVREUL died at his home in Paris, from natural exhaustion of his vital force, April 9th, at the age of one hundred and two years, eleven months, and nine days. He had lived very quietly since the celebration of the completion of his one hundredth year, August 31, 1886. He was accustomed to drive daily to see the progress made in the erection of the Eiffel Tower. His son, M. Henri Chevreul, had recently died; and, although the fact had not been communicated to him, he seemed to have some suspicion of it, and to be anxious. On his return from his last drive, the Wednesday before his death, he was very weak, and had to be helped, with some difficulty, up to his apartments; and it was evident that the end was approaching. He sank gradually, without pain, till the morning of the 9th, when he expired.

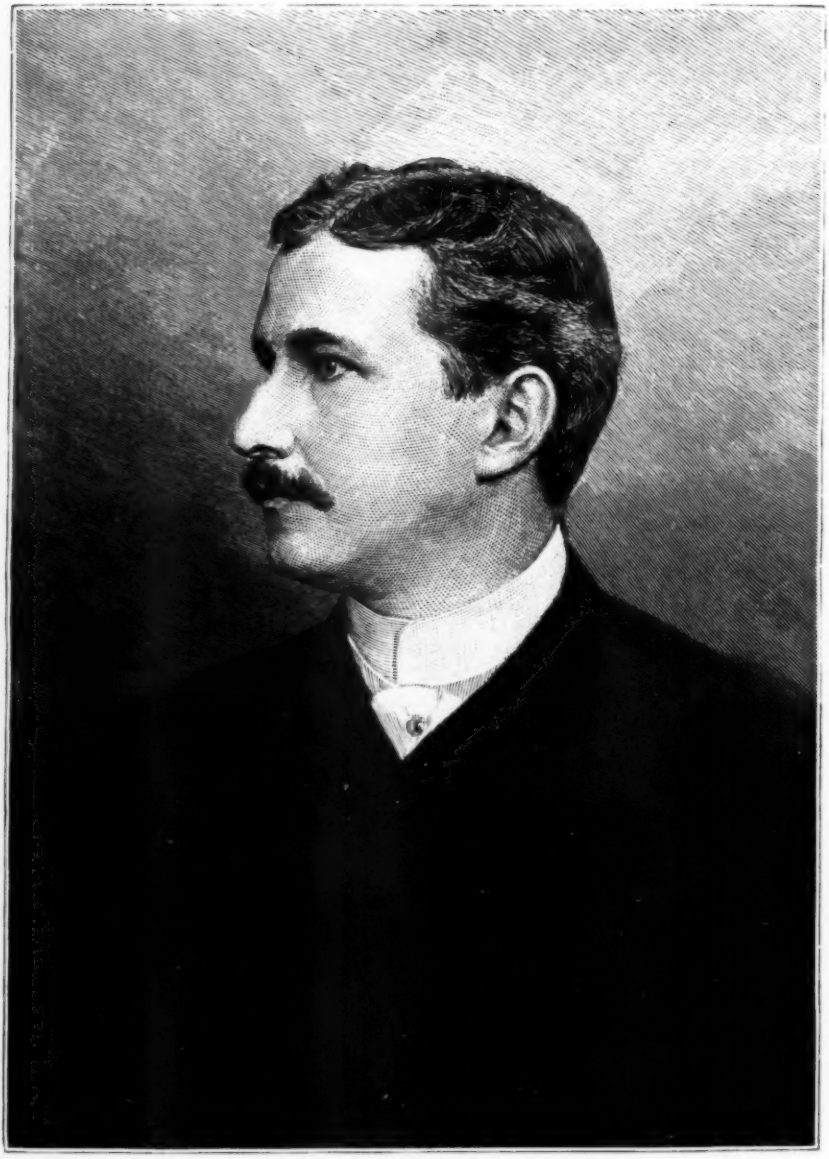
CHARLES MARTINS, an eminent student in several branches of science, died in Paris, March 7th, in his eighty-third year. He was appointed a Fellow in Natural History in the Faculty of Medicine in 1839; lectured on geology at the Sorbonne; became Professor of Botany at Montpellier in 1851; was elected to the Academy of Sciences, Section of Rural Economy, in 1863. He was also a great traveler; in his long career, he devoted himself with equal success to the study of meteorology, physics, botany, paleontology, comparative anatomy, and physiology. Wherever he went, he studied alike the customs, fauna and flora, and the physical phenomena of the region, and he described them all in his book, "From Spitzenberg to the Sahara." With Bravais and Lepileur he ascended Mont Blanc in 1844, and verified the results which De Saussure had reached.

PROF. DONDERS, of the University of Utrecht, one of the first of contemporary physiologists, has recently died. He was the author of valuable studies on accommodation (of eye-sight), binocular vision, astigmatism, and phonation, which have become standards.

THE Rev. Dr. Frederick A. P. Barnard, late President of Columbia College, died at his home in this city, April 27th, a few days less than eighty years of age. We gave a sketch of his earlier life in the "Monthly" for May, 1877, and purpose to publish in a future number a fitting memorial of the great services which he rendered to the cause of education.

M. G. MENINGHINI, Professor of Geology in the University of Pisa since 1849, died January 29th, seventy-eight years of age.

SIGNOR ANGELO GENOCCHI, President of the Academy of Sciences of Turin, died March 7th, aged seventy-one years.



HENRY CARVILL LEWIS.